

EAST HADDAM PUBLIC SCHOOLS

TECHNOLOGY EDUCATION
CURRICULUM

Grades 9-12

Approved by the
East Haddam Board of Education

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East Haddam Board of Education

Pamela Gourlie, Chairperson

Dora Lyman, Secretary

Everett Herden

Nicholas Iacovelli

Robert Mather

Thomas Miett

Manny Misenti

Steven Quinn

Melissa Ziobron

Steven Durham, Ed.D., Superintendent of Schools
East Haddam Board of Education
26 Plains Road, P.O. Box 401
Moodus, CT 06469
Phone (860) 873-5090/Fax (860) 873-5092
sdurham@easthaddam.k12.ct.us
www.easthaddam.k12.ct.us

Table of Contents

	<u>Page Number</u>
List of Committee Members	i
Statement of Philosophy	ii
Content Standards	iii
CAPT Improvement Plan Connection	iv
Courses	
➤ Introduction to Computer Assisted Drafting & Applied Science	1
➤ Computer Assisted Drafting & Design	14
➤ Architectural Drafting	37
➤ Transportation Systems	56
➤ Computer Integrated Manufacturing	71
➤ Manufacturing	87
➤ Graphic Communications/Desktop Publishing	100
➤ Engineering and Product Design	124
➤ World of Technology (Pilot 2005-06)	145

Technology Education Committee Members

Douglas Foster

Bruce Freeman

Statement of Philosophy

Technology is the use of knowledge and resources to modify the natural environment, satisfy human needs, solve problems and extend human capabilities which improve the quality of life on earth. Technology education is the study of human innovation, which provides an opportunity for students to apply and manage knowledge and resources related to the human made world. It incorporates collaborative, application-oriented, activity-based strategies used to develop creative thinking skills while solving real-world problems. The Technology Education Curriculum of the East Haddam School District prepares students to become lifelong contributing members of our technological society who comprehend the impact of technology and use it to improve the quality of life for all people.

Content Standards

The Connecticut Technology Education Curriculum Framework contains five content standards which were revised in 2004. The following Content Strands from the Connecticut State Curriculum Frameworks for Technology Education are incorporated throughout this curriculum:

1. The Nature & Evolution of Technology - Students will understand the nature of technology, how it has evolved and its influence on its own evolution.
2. The Impacts of Technology - Students will understand the impact that technology has on the personal, social, cultural, economic, political and environmental aspects of their lives.
3. The Research, Design & Engineering - Students will recognize technology as the result of a creative act, and will be able to apply formal problem-solving strategies to understand and enhance invention and innovation.
4. The Creation & Use of Technology - Students will know the origins, properties and processing techniques associated with the materials of technology as demonstrated by effective application of the methods producing usable products and by their effective(ly) use(ing) of those products.
5. The Future of Technology - Students will demonstrate the ability to take known principles of technological innovation and apply them to hypothetical scenarios effectively.

CAPT Improvement Plan Connection

Since reading and writing is an integral part of gaining the information and showing an understanding of the material presented in this class as well as all course work in high school, students will be assigned a number of activities in which they will have to read, research, write responsive essays, and/or answer open-ended questions about the material covered during this course of study. These assignments will be included in the normal course of study and are intended to increase the students' understanding of the information being studied as well as subsequent information about the topics not directly obtained from the text. The assignments will be of CAPT-like in design and require the students to:

1. Explain the main idea;
2. Interpret, predict and anticipate; cause and effect;
3. Evaluate the material read;
4. Observe, research, and recall information;
5. Summarize, organize and retell information; and
6. Reflect on the information obtained.

Also since the use of math skills are utilized in this course and part of the CAPT, some assignments will be utilized to increase the students' knowledge of various math skills. The assignments related to this portion of the curriculum will be noted with an (*) in each of the units of study under the suggested classroom illustrations.

INTRODUCTION TO COMPUTER ASSISTED DRAFTING & APPLIED SCIENCE CURRICULUM

Introduction

This course is designed for any student interested in learning about drafting as a career and for those students who may use the information & instruction from this area of study to prepare themselves for laboratory assignments and experiments in mathematics, chemistry, and physics.

First, students taking this class will be introduced to Computer Aided Drafting by learning the basic parts of a C.A.D. system, drafting principles, and geometrical construction. The creation of orthographic drawings as well as the use of the local area network as it relates to this area of study will be covered.

The second focus is on the operation and use of equipment and software in the designing and drawing of graphs and charts. The skills learned in this area are useful for any higher education course, which may require some means of visual support for the results or conclusions of assigned problems and experiments. This one semester, 1/2 credit course is open to all students in grades 9-12.

Curriculum Contents

This curriculum is divided into five units of study:

Unit I – Introduction to Drafting

Unit II – Introduction to CADD

Unit III – Geometric Construction

Unit IV – Orthographic Projections

Unit V – Charts and Graphs

Each unit contains:

- Applicable performance standards adapted from the Connecticut Technology Education Curriculum Framework
- The unit goal
- Learner outcomes
- Suggested classroom illustrations
- Suggested unit evaluation/assessment activities
- Supplemental activities and resources

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- describe Computer Assisted Drafting, (CAD) and give examples of where this technology is used;
- demonstrate the proper use of the terminology associated with CAD and computers;
- identify and describe component functions of a microcomputer CAD system;
- operate a computer and produce CAD drawings, charts and graphs using appropriate software;
- send and access information through a network;
- generate a computer image of objects in various views;
- generate a computer image of a chart or graph using given data; and
- export and import images in a variety of file forms.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I – INTRODUCTION TO DRAFTING

Unit Topics To Be Covered

1. Importance of drafting
2. Mechanical drawing
3. Career opportunities
4. Drafting standards
5. CAD systems

Unit Goal: Students will gain insight into how everything that we use today is made from plans or designs. Students will learn how the designs are initiated, first from ideas, then rough sketches to working drawings and then to prototypes. Students will also explore careers in the area of drafting and see how computer systems are used in this field of study.

Learner Outcomes

The students will:

- explain how drafting fits into the working world and grasp the importance of drawing as it pertains to the production of an object;
- demonstrate how sketching is a conversational tool to communicate ideas;
- recognize the essential aspects of bringing an idea to a final design;
- list career examples and describe the job opportunities that will open to him or her if they pursue this field;
- demonstrate an understanding of how a set of accepted standards apply to the different areas of drafting; and
- explain the advantages of how a CAD system relates to drafting and know how the system works.

Suggested Classroom Illustrations

- * Have students to check employment ads in the local newspaper for listings of positions related to the fields of drafting & design and then write a report on their findings related to the following: job titles, experience and education required, and starting salaries.
- Have students collect drawings and design from papers, magazines, local companies and the inter-net and produce a display for the bulletin board.
- Invite a drafter to speak to your class with examples of their work.
- Have them include samples of the various steps in the design process, rough sketches through technical illustrations and prototypes.
- Have students survey several industries in the area to determine their use of manual drafting vs. computer assisted drafting and create a pie chart showing the results.

Intro. to Computer Assisted Drafting & Applied Science Curriculum (Cont'd)
Unit I (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by completing a quiz made up of questions on the topics covered in this unit, such as occupations, vocabulary and or drafting standards.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using only paper and pencil have the students redesign a common household product and present their sketches to the class for discussion.

Supplemental Activities and Resources

- Have students read Chapter 1 in the textbook
- Teacher's Resource Binder
- Handouts
- Worksheets
- Color Transparency

UNIT II - INTRODUCTION TO CAD

Unit Topics To Be Covered

1. Hardware and Software
2. Logging into the network
3. Starting the CAD (Computer Aided Drafting) program
4. Simple CAD drawings
5. Saving work to their network
6. Network storage maintenance

Unit Goal: Students will examine CAD as a form of communication. They will learn that in order to draw correctly and efficiently a CAD system they must know how to communicate precise instructions in the proper sequence. They will learn that learning CAD is much like learning language arts in that the CAD software has both a vocabulary and syntax. The students will also learn that they must think through a drawing before they begin to create it.

Learner Outcomes

The students will:

- identify the basic hardware components used to run a CAD system;
- identify common CAD functions;
- identify entity selection, editing and modification techniques;
- identify geometric placement techniques;
- demonstrate the ability to boot-up and log into the CAD program;
- demonstrate the ability to develop a simple drawing using the CAD program;
- demonstrate the ability to save their work and close the CAD program; and
- demonstrate the ability to accomplish basic file maintenance on the network.

Suggested Classroom Illustrations

- Have students make posters from pictures in magazines or catalogs of the components that make up a CAD system.
- * Have students write a report and design a poster, describing a different CADD function.
- Ask students how many ways they could differentiate among themselves (gender, height, age, hair color, etc). Get them to understand that there are often many ways in which to categorize or select subjects or objects. Then proceed to discuss how to select various entities in a CAD program.
- Assign a CAD exercise in which students call up a drawing and select entities by various means.

Intro. to Computer Assisted Drafting & Applied Science Curriculum (Cont'd)
Unit II (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Test – At the end of this unit, have students complete an exam consisting of questions on CAD functions, hardware and software, and network management.
- Hands on Project – Using the assigned rubric, have the students use the CAD software demonstrate their understanding of the CAD software's vocabulary and syntax by creating a series of figures using lines, arcs, circles and polygons.

Supplemental Activities and Resources

- Have students read Chapter 15 in the textbook
- Teacher's Resource Binder
- Handouts
- Worksheets
- Color Transparency

UNIT III – GEOMETRIC CONSTRUCTION

Unit Topics To Be Covered

1. Geometric shapes
2. Lines, arcs, angles
3. Tangents
4. Geometric drawing
5. Polygons
6. Geometric design on CAD

Unit Goal: Students will examine how the drafter applies basic geometric construction techniques to problems that would be difficult to solve with any other technical system. In order to draw three-dimensional forms, it is necessary to understand how points, lines, and planes relate to each other in space to form shapes. Geometric Construction is one method for determining these relationships. The visualization required for this subject is easily developed when the student understands the projection of three-dimensional figures onto a two-dimensional paper. The Cartesian coordinate system used in CAD corresponds directly to the coordinate system used to solve geometric construction problems. When using CAD to solve these problems, it is important to make sure that one is working in the correct coordinate system. The students will practice drawing geometric figures both manually and using a CAD system. The students will also see that in technical drawing, geometric constructions are generally a means to an end, not the end product itself. That is, most completed drawings consist of a variety of basic geometric components such as points, lines, circles, squares, and so on. Each of these components intermeshes with other components to produce a completed drawing. This section will be taught with this idea foremost. At the end of this section the students will be assigned drawing problems that integrate geometric shapes into meaningful drawings. These problems provide ample opportunity to practice geometric construction in a realistic context.

Learner Outcomes

The students will:

- identify various geometric shapes, lines, arcs, angles, and tangents;
- construct various geometric shapes, lines, arcs, angles, and tangents manually;
- produce various geometric shapes, lines, arcs, angles, and tangents on a CAD system; and
- construct a drawing on the CAD system using several geometric shapes and drawing methods.

Suggested Classroom Illustrations

- * Have students draw different shapes of various sided figures.
- * Have students divide a circle into 15 equal parts.
- * Have students identify and describe various geometric shapes used by drafters.
- * Have students construct various geometric shapes using points, lines and planes from technical specifications using drafting instruments.
- * Have students complete an assignment that can be completed by closely following verbal directions or by solving a series of mathematical problems that culminate in a figure composed primarily of geometric shapes.
- * Have students apply geometric construction as a problem-solving tool through technical drawing assignments.

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Test – Using the assigned rubrics, have the students complete a series of exact geometric shapes from an assigned list, using the CAD system.
- Hands on Project – Teacher observation of students using the mechanical drafting equipment to construct various geometric shapes and problems.

Supplemental Activities and Resources

- Have students read Chapters 4 & 8 in the textbook
- Teacher's Resource Binder
- Handouts
- Worksheets
- Color Transparency

UNIT IV – ORTHOGRAPHIC PROJECTIONS

Unit Topics To Be Covered

1. Visualize objects
2. Multi-view drawings
3. Necessary views
4. Proper arrangement of views
5. Projection methods

Unit Goal: Students will examine that among the most important concepts to be mastered by the beginning drafter are multi-view drawing and the concept of orthographic projection. They will see that a complete understanding of orthographic projection is essential for success in developing more complex multi-view drawings. The students will understand that attention to detail is another important part of this unit. Things such as the alphabet of lines, the place and purpose of centerlines and hidden lines, which views to draw and where, the number of views necessary, and other similar items will be covered carefully and thoroughly.

Learner Outcomes

The students will:

- demonstrate the ability to visualize objects in the six principle planes using third-angle orthographic projection;
- demonstrate the ability to select and draw only the necessary views needed in describing an object;
- demonstrate the ability to correctly arrange multi view drawings; and
- demonstrate the ability to project features using common projection methods

Suggested Classroom Illustrations

- Have students label the parts of multi-view drawings from a handout.
- Have students complete an identification of missing views handout.
- Have students find hidden lines or missing lines in a problem.
- Have students sketch, on graph paper, multi-view orthographic projections of measured objects.
- * Have students write a descriptive essay explaining the steps needed to complete a multi-view drawing.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by accurately completing a visual perception handout by matching an object's principle plane's surfaces from a pictorial illustration onto an orthographic projection.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubric, have the students complete a series of orthographic projection drawings using the CAD System.

Supplemental Activities and Resources

- Have students read Chapter 5 in the textbook
- Teacher's Resource Binder
- Handouts
- Worksheets
- Color Transparency

UNIT V – CHARTS AND GRAPHS

Unit Topics To Be Covered

1. Uses of charts and graphs
2. Interpretation of data
3. Types of charts and graphs
4. Planning and laying out a chart or graph
5. Creating the charts and graphs with the computer

Unit Goal: Students will examine how the use of charts and graphs is an important part of their world. The students will examine how charts and graphs are important to scientists, engineers, mathematicians, doctors, nurses, and nearly everyone else in everyday life. Students will explore the variety of charts and graphs and how these tools can be made to show many different types of information visually.

Learner Outcomes

The students will:

- describe the use and importance of charts and graphs;
- choose the appropriate type of chart or graph to communicate most clearly the data being presented;
- prepare various types of charts and graphs from supplied data; and
- enhance the presentation of the completed charts and graphs with the use of color and creative symbology.

Suggested Classroom Illustrations

- Have students locate samples of charts and graphs from newspapers, magazines, technical manuals, or assembly instructions.
- Have students find 4 – 5 sets of data, such as sporting statistics, the past weeks daily temperatures, stock prices over the period of the past week, breaking distances at various speeds, or from lab exercises.
- * Have students, using graph paper and colored pencils, create charts or graphs from the data they have found and then write a report explaining and defending the results of the data and the graphs.
- Prepare the bulletin board with samples of student created charts and graphs from previous years as a reference that the students can see.

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Evaluate students' understanding through observation and class participation in the properly completing of graphs and charts using the skills outlined in the learner outcomes.
- Hands on Project – Using the assigned rubrics, have the students complete a series of charts and graphs given a set of established data packets using the CAD System.

Supplemental Activities and Resources

- Have students read Chapter 22 in the textbook
- Teacher's Resource Binder
- Handouts
- Worksheets
- Color Transparency

PRINT AND MEDIA RESOURCES

Books:

Mechanical Drawing – Board & CAD Techniques, French & Helsel, Glenco-McGraw-Hill, Peoria IL, 2003

Hardware:

Various pieces of mechanical drafting equipment including: drawing boards, T-squares, triangles, protractors, compasses, scales, drafting pencils and erasers; and up-to-date computer equipment configured to the standards required to run the present software.

Software:

Cadkey 19, Baystate Technologies Inc. Marlborough, MA, 2002, or most recent update available.

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, cooperative learning, group discussion, individualized tutoring, peer instruction and mentoring.

Instructional Materials:

Drafting equipment, computers and software, model construction supplies and equipment, reproduction equipment and supplies, and handouts appropriate to each unit.

Glencoe Publishers, Teacher Resource Guide for Mechanical Drawing – Board & CADD Techniques ISBN 0-07-825103-6, copyright 2003.

Portfolio Artifacts

1. Geometric Construction Package
2. Visual Perception Worksheets
3. Orthographic Projection Drawings & Test
4. Interpretation of Data Worksheets
5. Charts and Graphs Package & Test

COMPUTER ASSISTED DRAFTING & DESIGN CURRICULUM

Introduction

In this course, the student will be guided through instruction, demonstration, hands on activities and problem solving techniques in Computer Assisted Drafting & Design (CADD). CADD is the organized use of a computer systems and CADD software to perform drafting and design tasks. These tasks can range from simple geometric construction and the reproduction of existing drawings to the complex designing of new or better products. Since all drafting skills can be reduced to the use of lines, arcs, points, symbols, and text, all CADD systems deal with these basic elements and the many ways of grouping, reusing, and manipulating them to create a drawing. Through CADD programs these basic elements are used to create more complex drawings through the use of several input devices to form the drawing on the screen. Through the use of the software, the drawing can be modified, stored, or sent to a printer to produce a hard copy. This 1 credit course is open to all students in grades 9-12.

Curriculum Contents

This curriculum is divided into ten units of study:

Unit I – Introduction to Drafting

Unit II – Mechanical Drafting

Unit III – Introduction to CADD

Unit IV – Geometric Construction

Unit V – Orthographic Projections

Unit VI – Dimensioning

Unit VII – Isometric Drawings

Unit VIII – Sectional Drawings

Unit IX – Technical Illustrations

Unit X – Designs & Problem Solving

Computer Assisted Drafting & Design Curriculum (Cont'd)

Each unit contains:

- Applicable performance standards adapted from the Connecticut Technology Education Curriculum Framework
- The unit goal
- Learner outcomes
- Suggested classroom illustrations
- Suggested unit evaluation/assessment activities
- Supplemental activities and resources

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- describe Computer Assisted Drafting & Design, (CADD) and give examples of where this technology is used;
- demonstrate the proper use of the terminology associated with CADD and computers;
- identify and describe component functions of a microcomputer CADD system;
- operate a computer and produce CADD drawings using appropriate software;
- send and access information through a network;
- generate a computer image of objects in various views;
- generate a computer image of technical illustrations of objects;
- render objects to include texture, density, light and rotational movement; and
- export and import images in a variety of file forms.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I – INTRODUCTION TO DRAFTING

Unit Topics To Be Covered

1. Importance of drafting and design
2. Mechanical drawing
3. Architectural drawing
4. Career opportunities
5. Drafting standards
6. CAD systems

Unit Goal: Students will examine how everything that we use today is made from plans or designs and how these designs are initiated first from ideas then rough sketches to working drawings and then to prototypes. They will also explore careers in the area of drafting and design and finally see how the use of computer systems, teamwork and problem solving work together to complete a final product.

Learner Outcomes

The students will:

- explain how drafting fits into the working world and grasp the importance of drawing as it pertains to the production of an object;
- demonstrate how sketching is a conversational tool to communicate ideas;
- recognize the essential aspects of bringing an idea to a final design;
- identify the different applications of drafting such as mechanical, architectural, and others;
- list career examples and describe the job opportunities that will open to him or her if they pursue this field;
- demonstrate an understanding of how a set of accepted standards apply to the different areas of drafting;
- explain the advantages of how a CAD system relates to drafting and know how the system works; and
- list the steps in problem solving and tell why they are important.

Suggested Classroom Illustrations

- * Have students to check employment ads in the local newspaper for listings of positions related to the fields of drafting & design and then write a report on their findings related to the following: job titles, experience and education required, and starting salaries.
- Have students collect drawings and design from papers, magazines, local companies and the inter-net and produce a display for the bulletin board.

Computer Assisted Drafting & Design Curriculum (Cont'd)
Unit I (Cont'd)

Suggested Classroom Illustrations (Cont'd)

- Invite a designer or drafter to speak to your class with examples of their work.
- Have them include samples of the various steps in the design process, rough sketches through technical illustrations and prototypes.
- Have students survey several industries in the area to determine their use of manual drafting vs. computer assisted drafting and create a pie chart showing the results.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by completing a quiz made up of questions on the topics covered in this unit, such as occupations, vocabulary and or drafting standards.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using only paper and pencil have the students redesign a common household product and present their sketches to the class for discussion.

Supplemental Activities and Resources

- Have students read Chapter 1 in the textbook
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

UNIT II – MECHANICAL DRAFTING

Unit Topics To Be Covered

1. Basic Drafting Tools
2. The Alphabet of Lines
3. Creating a drawing from an idea
 - A. Sketches
 - B. Drawing with instruments
 - C. Dimensioning techniques
 - D. Lettering notes & labels
 - E. Various views used present the idea

Unit Goal: Students will examine the various mechanical drafting tools and how each is used to produce a finished product. They will be introduced to the various geometric shapes, types of lines, lettering techniques, and various views used to take a rough sketch to final presentation.

Learner Outcomes

The students will:

- demonstrate the ability to identify and properly use the drafting tools to measure draw lines, circles and arcs;
- explain the difference between scale and proportion;
- identify the different views used to represent an object; and
- identify types of dimensions, notes, labels, and retrieve facts about an object using these forms of information from an existing drawing.

Suggested Classroom Illustrations

- * Have a student write a descriptive essay of the various pieces of drafting equipment, which includes the name of each and its use.
- Have the students complete a vocabulary test that consists of the various terms covered in this section, drafting tools, alphabet of lines, geometric shapes and views.
- * Have students use the basic drafting tools to create a series of lines circles and arcs of various sizes and line types, (geometry problems).
- Have students complete an existing drawing with dimensions, notes and labels using the proper lettering skills.

Computer Assisted Drafting & Design Curriculum (Cont'd)
Unit II (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by assigning the review questions at the end of the chapter in the text.
- Test – At the end of this unit, have students answer questions on a test that will demonstrate their knowledge of tools and techniques used in mechanical drafting.
- Hands on Project – Using the assigned rubric, have the students use the basic drafting tools to construct a copy of an object or two from a series of handouts.

Supplemental Activities and Resources

- Have students read Chapters 2 & 3 in the textbook
- Teacher's Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

UNIT III – INTRODUCTION TO CAD

Unit Topics To Be Covered

1. Hardware and Software
2. Logging into the network
3. Starting the CAD (Computer Aided Drafting) program
4. Simple CAD drawings
5. Saving work to their network
6. Network storage maintenance

Unit Goal: Students will examine CAD as a form of communication. They will learn that in order to draw correctly and efficiently a CAD system they must know how to communicate precise instructions in the proper sequence. They will learn that learning CAD is much like learning language arts in that the CAD software has both a vocabulary and a grammar. The students will also learn that they must think through a drawing before they begin to create it.

Learner Outcomes

The students will:

- identify the basic hardware components used to run a CAD system;
- list advantages of CAD vs. mechanical drafting;
- identify common CAD functions;
- identify entity selection, editing and modification techniques;
- identify geometric placement techniques;
- demonstrate the ability to boot-up and log into the CAD program;
- demonstrate the ability to develop a simple drawing using the CAD program;
- demonstrate the ability to save their work and close the CAD program; and
- demonstrate the ability to accomplish basic file maintenance on the network.

Suggested Classroom Illustrations

- Have students make posters from pictures in magazines or catalogs of the components that make up a CAD system.
- * Have students write a report and design a poster, describing a different CADD function.
- Have students how many ways they could differentiate among themselves (gender, height, age, hair color, etc). Get them to understand that there are often many ways in which to categorize or select subjects or objects. Then proceed to discuss how to select various entities in a CAD program.
- Assign a CAD exercise in which students call up a drawing and select entities by various means.

Computer Assisted Drafting & Design Curriculum (Cont'd)
Unit III (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Test – At the end of this unit, have students answer questions on CAD functions, hardware and software, and network management.
- Hands on Project – Using the assigned rubric, have the students use the CAD software to construct a copy of an object or two from a series of handouts.

Supplemental Activities and Resources

- Have students read Chapter 15 in the textbook
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

UNIT IV – GEOMETRIC CONSTRUCTION

Unit Topics To Be Covered

1. Geometric shapes
2. Lines, arcs, angles
3. Tangents
4. Geometric drawing
5. Polygons
6. Geometric design on CAD

Unit Goal: Students will examine how the drafter, designer, and engineer apply basic geometric construction techniques to problems that would be difficult to solve with any other technical system. In order to draw three-dimensional forms, it is necessary to understand how points, lines, and planes relate to each other in space to form shapes. Geometric Construction is one method for determining these relationships. The visualization required for this subject is easily developed when the student understands the projection of three-dimensional figures onto a two-dimensional paper. The Cartesian coordinate system used in CAD corresponds directly to the coordinate system used to solve geometric construction problems. When using CAD to solve these problems, it is important to make sure that one is working in the correct coordinate system. The students will practice drawing geometric figures both manually and using a CAD system. The students will also see that in technical drawing, geometric constructions are generally a means to an end, not the end product itself. That is, most completed drawings consist of a variety of basic geometric components such as points, lines, circles, squares, and so on. Each of these components intermeshes with other components to produce a completed drawing. This section will be taught with this idea foremost. At the end of this section the students will be assigned drawing problems that integrate geometric shapes into meaningful drawings. These problems provide ample opportunity to practice geometric construction in a realistic context.

Learner Outcomes

The students will:

- identify various geometric shapes, lines, arcs, angles, and tangents;
- construct various geometric shapes, lines, arcs, angles, and tangents manually;
- construct a drawing using several geometric shapes and drawing methods;
- produce various geometric shapes, lines, arcs, angles, and tangents on a CAD system; and
- construct a drawing on the CAD system using several geometric shapes and drawing methods.

Computer Assisted Drafting & Design Curriculum (Cont'd)
Unit IV (Cont'd)

Suggested Classroom Illustrations

- * Have students draw different shapes of various sided figures.
- * Have students divide a circle into 15 equal parts.
- * Have students identify and describe various geometric shapes used by drafters.
- * Have students construct various geometric shapes using points, lines and planes from technical specifications using drafting instruments.
- * Have students complete an assignment that can be completed by closely following verbal directions or by solving a series of mathematical problems that culminate in a figure composed primarily of geometric shapes.
- * Have students apply geometric construction as a problem-solving tool through technical drawing assignments.

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Test – Evaluate students, understanding through class participation and skill demonstration of various aspects of geometric construction.
- Hands on Project – Using the assigned rubrics, have the students complete a number of geometric construction assignments using both mechanical drafting equipment and the CAD system.

Supplemental Activities and Resources

- Have students read Chapters 4 & 8 in the textbook
- Teacher's Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

UNIT V – ORTHOGRAPHIC PROJECTIONS

Unit Topics To Be Covered

1. Visualize objects
2. Multi-view drawings
3. Necessary views
4. Proper arrangement of views
5. Projection methods

Unit Goal: Students will examine that among the most important concepts to be mastered by the beginning drafter are multi-view drawing and the concept of orthographic projection. They will see that a complete understanding of orthographic projection is essential for success in developing more complex multi-view drawings, both in manual drafting and in CAD. The students will understand that attention to detail is another important part of this unit. Things such as the alphabet of lines, the place and purpose of centerlines and hidden lines, which views to draw and where, the number of views necessary, and other similar items will be covered carefully and thoroughly.

Learner Outcomes

The students will:

- demonstrate the ability to visualize objects in the six principle planes using third-angle orthographic projection;
- demonstrate the ability to center single and multiple view drawings on a sheet;
- demonstrate the ability to select and draw only the necessary views describing an object;
- demonstrate the ability to correctly arrange multi view drawings; and
- demonstrate the ability to project features using common projection methods.

Suggested Classroom Illustrations

- Have students label the parts of multi-view drawings from a handout.
- Have students complete an identification of missing views handout.
- Have students find hidden lines or missing lines in a problem.
- Have students sketch, on graph paper, multi-view orthographic projections of measured objects.
- * Have students write a descriptive essay explaining the steps needed to complete a multi-view drawing.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by accurately completing a visual perception handout comparing object surfaces from a pictorial illustration to an orthographic projection.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubric, have the students complete a series of orthographic projection drawings using the CAD System.

Supplemental Activities and Resources

- Have students read Chapter 5 in the textbook
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

UNIT VI – DIMENSIONING

Unit Topics To Be Covered

1. Dimensioning, symbols, and labels to working drawings according to industrial standards.
2. Dimensioning using aligned and unidirectional methods.
3. Dimensional tolerance to machine parts and features using either limit dimensions or plus and minus dimensions according to industrial standards.

Unit Goal: Students will examine how that concept of shape, in the orthographic projection drawings, combines with dimensioning, which deals with the size of an object, to describe graphically an object of any complexity. They will see that accuracy and completeness of each are essential to any technical drawing if it is to communicate fully. The students will examine that one of the best methods for understanding dimensioning is to consider an object in each of its basic geometric shapes and to dimension each shape individually. They will learn that when the dimensions needed to position the various elements in relation to one another are added, complete and accurate size description results. Students will also understand that proper wording and placement of notes are also important and that the notes must contain all necessary information for the machinist to complete the operation specified.

Learner Outcomes

The students will:

- apply dimensions, symbols, and labels to working drawings according to industrial standards on both mechanical drawings and CAD drawings; and
- apply dimensional tolerance to machine parts and features using either limit dimensions or plus and minus dimensions according to industrial standards on both types of drawings.

Suggested Classroom Illustrations

- Have the students complete orthographic projection drawing handouts that are missing dimensions and notes.
- Prepare the bulletin board with samples of student drawings that have been completed with dimensions and notes as a reference that the students can see.
- Have students complete an exercise in which a drawing is dimensioned to determine if the dimensions on the handout are correct as for their size and/or location.
- * Have students write a descriptive essay explaining the steps needed to complete the dimensioning process and explaining the need for accurate dimensioning.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by having them correct missing or misplaced dimensions on a series of handouts.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubrics, have the students using the CAD system, add dimensions to the orthographic projection drawings they completed in the previous unit.

Supplemental Activities and Resources

- Have students read Chapter 6 in the textbook
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

UNIT VII – ISOMETRIC DRAWINGS

Unit Topics To Be Covered

1. Isometric drawings
2. Isometric construction
3. Isometric templates
4. Creation of isometric drawings
5. CAD generated isometric drawings

Unit Goal: Students will examine how isometric drawings are used in industry to enable the drafter to give a clearer representation of an object to the client. The students will learn how the use of isometric drawings aids in the creation of advertising sheets, illustrated parts lists and instruction manuals.

Learner Outcomes

The students will:

- list three applications of isometric drawings that demonstrate their unique characteristics in the field of drafting;
- explain the advantages of an isometric drawing compared to an orthographic drawing;
- identify the three common types of isometric drawings – wire frame, hidden and shaded-rendered; and
- accurately complete an isometric drawing using the CAD system, when given dimensioned orthographic projection drawing.

Suggested Classroom Illustrations

- Have students to locate samples of isometric drawings from newspapers, magazines, technical manuals, or assembly instructions.
- Have students create isometric sketches of an object or two.
- Have students draw isometric circles (ellipses) using the various methods covered in the textbook.
- * Have students write a descriptive essay explaining the steps needed to complete an isometric drawing and explaining the uses of isometric drawings.
- Prepare the bulletin board with samples of student isometric drawings from previous years as a reference that the students can see.

Computer Assisted Drafting & Design Curriculum (Cont'd)
Unit VII (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Evaluate students' understanding through observation and class participation.
- Hands on Project – Using the assigned rubrics, have the students complete a series of isometric drawings using the CAD System.

Supplemental Activities and Resources

- Have students read Chapter 12 in the textbook
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

UNIT VIII – SECTIONAL DRAWINGS

Unit Topics To Be Covered

1. Methods of printing
2. Uses of sectional drawings
3. Types of sectional drawings
4. Types of standard sectional fill symbols, (crosshatching)
5. Special cases used in sectional drawings; ribs & webs, parts not sectioned and conventional breaks

Unit Goal: Students will examine how visualization is an important element in doing sectional drawings. They will learn that once they can develop a mental picture of the interior hidden details of an object that a section drawing is no more difficult to complete than an orthographic drawing. Students will explore the common uses of sectional drawings in industry and how a product detailed interior can be a selling point. Students will have a clear understanding and appreciation of the fact that the CAD system is an important tool with its ability to automatically draw the sectional filling.

Learner Outcomes

The students will:

- describe the purpose of sectional drawings;
- select the appropriate type of sectional drawing to show an object's hidden features;
- select the correct crosshatching for the materials used in producing the object;
- select the proper path of the cutting plane to represent the type of section drawing; and
- describe conventional breaks and symbols and why standard break symbols must be used and not just made up by the drafter.

Suggested Classroom Illustrations

- *Have students to locate samples of sectional drawings from newspapers, magazines, technical manuals, or assembly instructions and write a report on the types and uses of sectional drawings as they pertain to the samples found in the materials listed above.
- Have students create sectional sketches of an object or two.
- Have students create a poster illustrating the various standard crosshatchings and list of materials each represents as covered in the textbook.
- Prepare the bulletin board with samples of student sectional drawings from previous years as a reference that the students can see.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by assigning the review questions at the end of the chapter in the text.
- Test – Have students demonstrate their knowledge of this topic by completing a test on the various aspects and uses of sectional drawings.
- Hands on Project – Using the assigned rubric, have the students complete a series of sectional drawings using the CAD System, choosing the proper type of sectional drawing, crosshatching, and breaks and symbols to best represent the objects assigned.

Supplemental Activities and Resources

- Have students read Chapter 9 in the textbook
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

UNIT IX – TECHNICAL ILLUSTRATIONS

Unit Topics To Be Covered

1. Uses of technical illustrations
2. Types of technical illustrations
3. Assembly views
4. Exploded views
5. Notes and specifications
6. Bill of materials

Unit Goal: Students will realize how the knowledge, skills, and techniques they developed during the previous units of study and brought together to create technical illustrations. The students will examine how the technical illustration graphically communicates to the production worker every detail of the designer's idea about an object. They will also realize how the CAD system offers many time saving features.

Learner Outcomes

The students will:

- define a technical illustration, exploded drawing, assembly drawing and bill of materials;
- list various uses for technical illustrations;
- describe and produce the various drawings that make up technical illustrations;
- develop a bill of materials or parts list; and
- create rendered and photo real illustrations of assigned objects.

Suggested Classroom Illustrations

- Have students to locate samples of technical illustrations and rendering drawings from newspapers, magazines, technical manuals, or assembly instructions.
- * Have the students write a descriptive essay that will compare and contrast an orthographic drawing, an isometric drawing, a sectional drawing, and a technical illustration.
- Have students create sketches depicting an illustration and rendering of an object or two.
- Have students locate samples of bills of materials from instruction sheets or user manuals from household products.
- Prepare the bulletin board with samples of student technical illustration drawings from previous years as a reference that the students can see.
- Invite a designer or drafter who specializes in airbrushing and rendering techniques to speak to your class with examples of their work. Have them include samples of the various types of renderings they produce.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by assigning the review questions at the end of the chapter in the text.
- Evaluate students' understanding through observation of lab work.
- Hands on Project – Using the assigned rubric, have the students complete a series of technical illustrations, renderings and photo real drawings using the CAD System, illustrating various projects in both exploded and assembly views and create a bill of materials.

Supplemental Activities and Resources

- Have students read Chapter 11 in the textbook
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

UNIT X – DESIGNS & PROBLEM SOLVING

Unit Topics To Be Covered

1. Problem solving
2. Teamwork
3. Product design team – positions and responsibilities
4. Design drawings
5. Product specifications and reports

Unit Goal: Students will examine the aspects of being a designer. Now that the students have obtained the basic skills and knowledge of the various types of drawings used in the drafting field they will now, through a series of problem solving exercises, examine how all products we use in our daily lives first start out as a basic design in someone's mind and with the aid of members of the design team and by solving problems a primary drawing for the product can be reached. The students will work as members of a team to create all the drawings needed to complete a set of plans including orthographic, isometric, sectional drawings, technical illustrations, renderings and bill of materials.

Learner Outcomes

The students will:

- describe the role and importance of a drafting technician;
- define key terms used in the field of drafting as covered throughout the course;
- list and describe the four levels of graphic communication;
- identify the roles and responsibilities of the members of an engineering team.

Suggested Classroom Illustrations

- Arrange the class into 3 or 4 engineering design teams.
- * Have the teams to work together to complete a series of assigned tasks, such as, creation of a multiple-choice test, vocabulary test or crossword puzzle using various terms they have learned during the course and have the other teams take each other's tests or solve the puzzles.
- * Have teams describe in writing a simple object and have the other teams draw the object to scale as best they can.
- * Have the teams choose a product and then create an advertisement for the product and present it to the other groups.
- Have the students work within their groups to redesign a common item, using the skills they have learned, creating the full set of drawings that are required as part of an engineering package in order for a product to be produced.

Computer Assisted Drafting & Design Curriculum (Cont'd)
Unit X (Cont'd)

Suggested Unit Evaluation/Assessment

- Class observation of students' ability to work as a team member on the various assigned classroom illustrations
- Completion of final portfolio assignment for this class, consisting of exceptional samples of the various forms of drawings they have completed this year.
- Hands on Project – Using the assigned rubrics, have the students work within their groups to design a product of the teams choice, using the skills they have learned, creating the full set of drawings that are required as part of an engineering package in order for a product to be produced.

Supplemental Activities and Resources

- Have students re-read Chapter 1 in the textbook.
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

PRINT AND MEDIA RESOURCES

Books:

Mechanical Drawing – Board & CAD Techniques, French & Helsel, Glenco-McGraw-Hill, Peoria IL, 2003

Hardware:

Various pieces of mechanical drafting equipment including: drawing boards, T-squares, triangles, protractors, compasses, scales, drafting pencils and erasers; and up-to-date computer equipment configured to the standards required to run the present software.

Software:

Cadkey 19, Baystate Technologies Inc. Marlborough, MA, 2002, or most recent update available.

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, cooperative learning, group discussion, individualized tutoring, peer instruction and mentoring.

Instructional Materials:

Drafting equipment, computers and software, model construction supplies and equipment, reproduction equipment and supplies, and handouts appropriate to each unit.

Glencoe Publishers, Teacher Resource Guide for Mechanical Drawing – Board & CADD Techniques ISBN 0-07-825103-6, copyright 2003.

Portfolio Artifacts

1. Mechanical Drawings Package
2. Geometric Construction Package
3. Orthographic Projection Drawings & Test
4. Isometric Drawings & Test
5. Technical Illustrations & Test
6. Mid-Term Exam
7. Sectional Drawings & Test
8. Design Solutions for Problem Solving Assignments

ARCHITECTURAL DRAFTING CURRICULUM

Introduction

Open to students in grades 10-12, this 1 credit full year course will instruct students on how to use a C.A.D. system to design, draft, and model a house and other small architectural projects. Work will be performed on the computer using DataCAD architectural software that has been designed to help students produce useful drawings with increased efficiency and precision. Students will receive instruction and hands on experience in planning a design, drawing a floor plan, inserting doors, windows, fixtures, adding dimensions, creating site plans, elevations and perspective drawings to each students' architectural "Dream House" project portfolio. It is highly recommended that students take either the CADD or Intro to CADD course prior to taking this class.

Curriculum Contents

This curriculum is divided into eight units of study:

Unit I – Architectural History, Styles and Fundamentals of Design

Unit II – Architectural Careers

Unit III – Primary Considerations – Environmental Factors and Living Area Planning

Unit IV – Room Planning and Designing Floor Plans

Unit V – The Site: Plans and Development

Unit VI – Pictorial Drawings and Renderings

Unit VII – Principals of Construction

Unit VIII – Building Costs, Financial Planning, Codes and Legal Documents

Each unit contains:

- Applicable performance standards adapted from the Connecticut Technology Education Curriculum Framework
- The unit goal
- Learner outcomes
- Suggested classroom illustrations
- Suggested unit evaluation/assessment activities
- Supplemental activities and resources

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- trace the historical development of the architectural construction industry;
- identify career opportunities in the areas of communications and architectural design;
- define and demonstrate a personal work ethic;
- use research techniques to support design development;
- apply organizational skills to classroom and laboratory activities;
- develop a personal time management plan;
- describe Computer Assisted Drafting & Design, (CADD) and give examples of where this technology is used;
- demonstrate the proper use of the terminology associated with CADD and computers;
- identify and describe component functions of a microcomputer CADD system;
- operate a computer and produce CADD drawings using appropriate software;
- send and access information through a network;
- generate a computer image of objects in various views;
- generate a computer image of technical illustrations of objects;
- render objects to include texture, density, light and rotational movement;
- export and import images in a variety of file forms;
- describe and/or apply the process of site selection and preparation; and
- complete a cost estimate of a small residential structure.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I – ARCHITECTURAL HISTORY, STYLES AND FUNDAMENTALS OF DESIGN

Unit Topics To Be Covered

1. The history and development of architectural forms
2. How architectural styles developed
3. Influences on early American architecture
4. Early American styles
5. Later American styles
6. New challenges in architecture
7. Architecture and design
8. Elements of design
9. Principles of design

Unit Goal: Students will examine the history of architecture and how the way people live changes what types of dwelling they live in. The students will also study and evaluate the broad range of architectural styles and how lifestyles and culture influences the architectural designs. Students will look at how future development of construction materials and methods as well as the way people live in society can influence future architectural design.

Learner Outcomes

The students will:

- recognize historical architectural styles and identify several distinct characteristics of each style;
- explain how the development of materials and construction methods influenced architectural styles;
- relate design concepts to architecture;
- identify six elements of design; and
- apply design principles to a work of architecture.

Suggested Classroom Illustrations

- * Have students to check employment ads in the local newspaper for listings of positions related to the field of architecture and then write a report on their findings responding to a series of questions covering, job titles, experience and education required, and starting salaries.
- Have students collect architectural drawings and design from papers, magazines, local companies and the inter-net and produce a display for the bulletin board.

Architectural Drafting Curriculum (Cont'd)
Unit I (Cont'd)

Suggested Classroom Illustrations (Cont'd)

- Invite an architectural designer to speak to your class with examples of their work. Have them include samples of the various steps in the design process, rough sketches through complete blue prints.
- Have students attend a field trip to various construction sites in the community to see first hand the connection of the architectural plans and the construction process.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by completing a quiz made up of questions on the topics covered in this unit, such as occupations, vocabulary and or architectural drafting standards.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using only paper and pencil, have the students make rough sketches of a post and lintel arch, barrel vault, dome and Gothic arch.

Supplemental Activities and Resources

- Have students read Chapters 1 & 2 in the textbook.
- Teacher's Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

UNIT II – ARCHITECTURAL CAREERS

Unit Topics To Be Covered

1. Careers in architectural design
2. Careers in construction-related engineering
3. Opportunities for education and training
4. Educational requirements

Unit Goal: Students will examine the various career opportunities in architecture and related areas. The students will gain insight and information of other careers such as, city planners, model makers, landscape and interior designers, as well as civil and structural engineers, to name a few, that work together with the architectural designer in the completion of the final structure. The students will also explore the educational requirements and how and where to go about getting the training and education to work in an architectural related career.

Learner Outcomes

The students will:

- demonstrate the ability to name and describe the careers opportunities available in architecture and its related fields;
- identify skills and knowledge required in specific careers in architectural design, engineering design, and construction;
- name and describe educational and training programs available to prepare them for a career in architecture or its related fields;
- list educational requirements for specific careers in and related to architecture; and
- contact sources of further information about the various careers in architecture and related areas.

Suggested Classroom Illustrations

- Have students demonstrate an understanding of the skills and knowledge required in each professional and technical career in architecture requires by completing a chart listing some of the careers and what the requirements are to obtain that career.
- * Have students interview a person in a career related to architecture and write a report on the interview.
- Using a prepared handout have the students demonstrate their understanding of the differences between the professional and the technical occupations related to architecture.
- * Have students research a career in architecture, and write a report to share with the other members of the class about their findings.

Architectural Drafting Curriculum (Cont'd)
Unit II (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by assigning the review questions at the end of the chapter in the text.
- Test – At the end of this unit, have students answer questions on a test that will demonstrate their knowledge of architectural careers and career planning.
- Hands on Project – Using the assigned rubric, have the students complete one of the written report assignments listed above.

Supplemental Activities and Resources

- Have students read Chapters 38 & 39 in the textbook.
- Teacher's Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

UNIT III – PRIMARY CONSIDERATIONS – ENVIRONMENTAL FACTORS AND LIVING AREAS PLANNING

Unit Topics To Be Covered

1. Building orientation factors
2. Ergonomic planning
3. Ecological factors
4. Indoor living area planning
5. Outdoor living area planning
6. Traffic areas and patterns

Unit Goal: Students will examine how a wide range of factors must be considered in the development of a fully functional architectural design. They will learn how such things as geographical area, climate, the land and energy sources influence a buildings design and how such considerations must be looked at in an attempt to protect and improve the environment. The students will also learn how to plan the interior and exterior living areas of a structure in a way that the elements blend together and complement the whole structure, and how traffic pattern planning is an important consideration of the overall design, in order to have an efficient use of space.

Learner Outcomes

The students will:

- orient a structure on a lot to take the best advantage of solar energy as well as other features of the lot;
- design structures ergonomically;
- explain ways to prevent pollution or other effects on the ecology;
- identify the functions of indoor living area rooms;
- explain how a room's orientation, walls, floor, ceiling, windows and lighting contribute to its function and appearance;
- determine the effectiveness of a traffic pattern in a house; and
- design interior and exterior living areas and work them into a convenient and efficient floor plan.

Architectural Drafting Curriculum (Cont'd)
Unit III (Cont'd)

Suggested Classroom Illustrations

- * Have students write a descriptive essay, listing environmental factors involved in protecting a building site.
- Have design and sketch the location, size, and shape of indoor living areas using graph paper.
- Have students to design and sketch various outdoor living areas such as porches, patios, and swimming pools.
- * Have students complete a handout of mathematical calculations determining various rooms, and outside living area sizes in area and volume.

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Test – At the end of this unit, have students answer questions on factors that must be considered when designing a structure in relation to the environment, interior and exterior living and traffic patterns.
- Hands on Project – Using the assigned rubric, have the students use the CAD software, room planning materials and templates design a living room, dining room, kitchen, bedroom, and patio.

Supplemental Activities and Resources

- Have students read Chapters 6, 7, 8, 9 in the textbook
- Teacher's Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

UNIT IV – ROOM PLANNING AND DESIGNING FLOOR PLANS

Unit Topics To Be Covered

1. Floor plan development
2. The design process
3. Functional space planning
4. Accommodating special needs
5. Types of floor plans
6. Floor plan symbols
7. Steps in drawing floor plans
8. Floor plan dimensioning

Unit Goal: The students will discover that the floor plan is the most commonly used architectural drawing. The students will gain an insight that it is a completed set of scaled drawings which consists of the outline, room partitions and layout of a building as seen if the building were cut horizontally about 4' above the floor line. Students will use information from the previous unit of study along with the material to be covered in this unit to develop a residential floor plan. The design plan will include: the initial defining of the project to design conception, room needs and layout, traffic patterns, floor plan sketches, and a finished plan using the CAD system and software.

Learner Outcomes

The students will:

- gather all information that is needed to design an architectural project;
- analyze a building site;
- use the design process to prepare for drawing accurate and functional floor plans;
- create floor plan sketches;
- design floor plans to accommodate the needs of persons with physical impairments;
- use information from sketched floor plans to create a finished floor plan according to a sequencer of steps;
- accurately add dimensions and graphic symbols to communicate information about the floor plan to others; and
- name and explain specialized floor plans used for noting utilities used in the completed building.

Suggested Classroom Illustrations

- Have students complete a list the design steps necessary to design a residence from conception through the development of the final product.
- Have students learn proper room and traffic patterns through the use of room templates, by arranging them for sleeping area, service area, and living area, then share their results with the class.
- Have students gain dimensioning skills by adding dimensions on an original scaled floor plan.
- Have students sketch and dimension the floor plan of the house they presently live in.
- * Have students write a design statement for the house they would like to design, their “Dream House”, and include statements to show how they defend their design.

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Test – Evaluate students, understanding through demonstration of knowledge of the elements of design, room size and relationship of individual rooms to overall design, and different floor plan symbols.
- Hands on Project – Using the assigned rubrics, have the students complete a floor plan for a single story residential structure using the CAD software and equipment.

Supplemental Activities and Resources

- Have students read Chapters 13 & 14 in the textbook
- Teacher’s Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

UNIT V – THE SITE: PLANS AND DEVELOPMENT

Unit Topics To Be Covered

1. Site analysis
2. Zoning ordinances
3. Survey plans
4. Plot plans
5. Landscape plans
6. Landscape rendering

Unit Goal: Students will examine in this unit that site planning and development is an integral part of the design process. They will understand that the sequence presented in this unit of study should be followed carefully when developing a site plan. They will also learn that the site plan should provide proper orientation of all structures on the site in relationship to the natural features and characteristics of the land. The students will also learn that specialized plans and designs must be created as part of the site plan package. These specialized plans include the survey plan, landscape plans and final rendering of the site.

Learner Outcomes

The students will:

- identify the major elements of site design;
- demonstrate an understanding of the role and uses of zoning ordinances in the design process;
- demonstrate the ability to describe and draw survey, plat and plot plans;
- accurately explain the polar coordinate system and its application to site plans; and
- demonstrate the ability to correctly design, draw and render landscape plans.

Suggested Classroom Illustrations

- Have students sketch the layout of their yard including location of any structures and landscape elements.
- * Have students, using the inter-net, locate and list specific zoning ordinances related to their town and write a report on their findings.
- Have students complete a handout requiring them to identify local plants and trees.

Architectural Drafting Curriculum (Cont'd)
Unit V (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by accurately completing a sample survey map by adding proper symbols and notations listed on a corresponding handout.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubric, have the students complete a series of plot plans and landscape designs related to their house design, when given a specific piece of property.

Supplemental Activities and Resources

- Have students read Chapter 18 in the textbook
- Teacher's Resource Binder material for this chapter
- Handouts related to this chapter
- Worksheets from workbook related to this chapter
- Color Transparency from teacher binder related to this chapter

UNIT VI – PICTORIAL DRAWINGS AND RENDERINGS

Unit Topics To Be Covered

1. Types of pictorial projections
2. Perspective drawings
3. Choosing a media for rendering
4. Showing the effects of light
5. Texture
6. Landscape
7. Steps in preparing a rendering

Unit Goal: Students will learn how to complete a series of pictorial drawings and renderings of their “Dream House” to show a more realistic picture of the house. Students will be able to demonstrate an understanding that pictorial drawings is a form of perspective representation which shows several sides of an object in one drawing and have lines that recede, creating an illusion of depth and that in a rendering the addition of color, texture, shades, shadows, and landscape features add even more realism to the final product.

Learner Outcomes

The students will:

- differentiate between isometric, oblique, and perspective drawings;
- correctly demonstrate the geometric principles involved in projecting lines to create 3-D imaged;
- design interior and exterior pictorial drawings by applying the principles of perspective drawing;
- list and describe the wide selection of media available for creating renderings;
- correctly determine when to use which media to achieve an artistic effect;
- follow the correct sequence for preparing a rendering; and
- create a rendering by adding realism to a pictorial drawing by the use of texture, shade, shadow, and landscape elements.

Suggested Classroom Illustrations

- Have the students collect samples of architectural pictorial and rendered drawings for magazines, newspapers or off the inter-net.
- Have students sketch a perspective illustration of portion of the school.
- Have students draw, using the CAD equipment, a two-point perspective of a building from a photograph.

Architectural Drafting Curriculum (Cont'd)
Unit VI (Cont'd)

Suggested Classroom Illustrations (Cont'd)

- Have students add items to their sketch of the school to complete a rendering.
- * Have the students write a five to six paragraph description of their personally designed house and landscaping, which could be put in the newspaper or a real estate's guide.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information complete a handout of vocabulary terms associated with pictorial drawings and renderings.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubrics, have the students using the CAD system, create a packet of pictorial drawings and renderings of the house and lot they have been designing.

Supplemental Activities and Resources

- Have students read Chapters 19 & 20 in the textbook
- Teacher's Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

UNIT VII – PRINCIPLES OF CONSTRUCTION

Unit Topics To Be Covered

1. Structural design
2. Structural forces
3. Strength of materials
4. Wood frame systems
5. Masonry & Concrete systems
6. Steel systems
7. Modular construction systems
8. Disaster prevention design

Unit Goal: Students will examine how even though the basic principles for preparing construction drawings are the same for all types of construction, the use of symbols, established techniques, and terms changes drastically from system to system. The students will learn that most contemporary architectural designs include a combination of systems such as wood, steel, masonry and concrete and how each system comes together to complete the finished structure. Students will also discover how structural forces of materials and strength of materials are important considerations in the design of a structure and how these are all figured into the design to prevent or minimize damage caused by disaster.

Learner Outcomes

The students will:

- name and define the physical forces that act on a building;
- describe the factors that determine the strength of structural components;
- describe the various types of, the components of and materials used in foundations;
- differentiate between skeleton-frame and post-and-beam construction;
- calculate the number of board feet in a piece of lumber;
- identify types of masonry materials and the ways of strengthening of concrete used in construction;
- describe three types of steel construction; and
- describe the measures that can be taken during construction to minimize potential damage from natural disasters.

Architectural Drafting Curriculum (Cont'd)
Unit VII (Cont'd)

Suggested Classroom Illustrations

- * Have students to calculate the load of a roof in various parts of the country when given its size.
- Have students complete a word search or crossword puzzle consisting of all the terms related to this area of study.
- * Have students calculate the live and dead load of the living areas of their house design.
- * Have students complete a handout consisting of math problems dealing with figuring board feet of various materials.
- Have students draw the symbols for the various welds used in steel construction.
- * Have the students to write an essay on the design features they should use in their house design to prevent damage from natural disaster.

Suggested Unit Evaluation/Assessment

- Quizzes – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Evaluate students' understanding through observation, class participation and completion of classroom activities listed above.
- Hands on Project – Using the assigned rubrics, have students complete a foundation plan for their house design.

Supplemental Activities and Resources

- Have students read Chapters 22, 23, 24, 25, 26, 27 in the textbook
- Teacher's Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

UNIT VIII – BUILDING COSTS, FINANCIAL PLANNING, CODES AND LEGAL DOCUMENTS

Unit Topics To Be Covered

1. Building costs
2. Cost estimating methods
3. Minimizing costs
4. Financial planning
5. Budgets and financial qualifications
6. Building codes
7. Legal Documents

Unit Goal: Students will examine how the total cost of a building and the financing of the structure must be planned carefully. They will learn about all the building costs and financing aspects that must be considered before work is begun on the building, and that the designer must work to create plans that will provide the best structure for the finances available. Through this examination the students will receive information that will be helpful in their own lives as they go beyond high school and become homeowners and citizens in the community. The students will also gain insight into the array of governmental laws and codes imposed to control the design and construction of buildings. The students will examine the legal documents that have been created to protect the architect, builder, client, and the general public needed in the construction of a new building.

Learner Outcomes

Students, upon completion of this unit will be able to:

- describe building costs including cost estimating methods and minimizing costs;
- estimate building costs by the square foot method and cubic volume;
- make up a home budget;
- calculate monthly payments;
- list all factors that must be considered in the financial planning of a new structure;
- determine building codes in reference to their architectural designs; and
- list legal documents needed for building construction.

Suggested Classroom Illustrations

- * Have students to use the inter-net to find local financial companies that provide for new construction and their present lending rates and requirements and write a report on their findings.
- * Have students complete a handout of problems that relate to building costs of various structures.
- Have students, using the inter-net locate local building codes and regulations and list how they are related to the designs the students are working on.
- * Have the students make up a monthly budget considering all aspects of their plans for the future; such as what their income might be depending on their desired occupation and what expenses they may have.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by assigning the review questions at the end of the chapter in the text.
- Test – Have students demonstrate their knowledge of this topic by completing a test on estimating methods and minimizing costs.
- Hands on Project – Using the assigned rubric, have the students compile list of building costs, mortgage rates and monthly payments, building codes and other legal documents needed for the building of their architectural design.

Supplemental Activities and Resources

- Have students read Chapters 36 & 37 in the textbook
- Teacher's Resource Binder material for these chapters
- Handouts related to these chapters
- Worksheets from workbook related to these chapters
- Color Transparency from teacher binder related to these chapters

PRINT AND MEDIA RESOURCES

Books:

Architectural Drafting and Design, Donald E. Helper, Paul Ross Wallach and Dana J. Helper, Glenco-McGraw-Hill, Peoria IL, 2001 or newer edition as available.

Hardware:

Various pieces of mechanical drafting equipment including: drawing boards, T-squares, triangles, protractors, compasses, scales, drafting pencils and erasers. As well as Computers, Printers and Scanners configured to the standards required of the run present software.

Software:

Cadkey 19, Baystate Technologies Inc. Marlborough, MA, 2001, or most recent update available.
DataCad 10, DataCad LLC, Avon CT, 06001. 2001, or most recent update available

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, cooperative learning, group discussion, individualized tutoring, peer instruction and mentoring.

Instructional Materials:

Drafting equipment, computers and software, model construction supplies and equipment, reproduction equipment and supplies, and handouts appropriate to each unit.

Glencoe Publishers, Teacher Resource Binder for Architectural Drafting and Design
ISBN 0-02-637068-9, copyright 2001, or newer edition as available.

Portfolio Artifacts

1. Rough sketches of architectural arches and vaults
2. Research paper on a career in architecture
3. Basic CAD designs for a living room, dining room, kitchen, bedroom and patio
4. Completed dimensioning assignment of an original scaled floor plan
5. Set of plans for a single story residential structure
6. Set of floor plans for a house of their own design, "Dream House"
7. Set of plot plans and landscape designs for their "Dream House"
8. Packet of pictorial drawings and renderings of the students "Dream House and lot
9. Foundation plan of the "Dream House"
10. Complete packet of building costs, mortgage rates and monthly payments, building codes and legal documents needed to construct the "Dream House"

TRANSPORTATION SYSTEMS CURRICULUM

Introduction

In this course, we will study how people use the elements of technology to design and produce systems for the purpose of moving people and goods within our society. Energy and power technology play an important part in keeping our transportation systems operating. Using hands-on lab activities, we will study terrestrial, atmospheric, marine, and space transportation systems, their related energy and power needs, and the social, environmental and economic impacts.

Curriculum Contents

This curriculum is divided into six units of study:

Unit I – Introduction to Transportation Systems

Unit II – Energy

Unit III – Land Transportation Systems

Unit IV – Air Transportation Systems

Unit V – Space Transportation Systems

Unit VI – Marine Transportation Systems

Each unit contains:

- Applicable performance standards adapted from the Connecticut Technology Education Curriculum Framework
- The unit goal
- Learner outcomes
- Suggested classroom illustrations
- Suggested unit evaluation/assessment activities
- Supplemental activities and resources

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- critically analyze a given technology against a perceived need or want;
- describe the transformation and conservation of kinetic and potential energy in mechanical, chemical and electrical systems;
- explore and describe how electricity is generated, transferred and used in modern technologies;
- use the systems model to analyze a complex technological system;
- describe the evolution of a technological system and its influence on the economy, culture, society and environment;
- identify and explore career opportunities in the areas of technology;
- investigate multiple solutions to a design problem;
- select appropriate technical processes and fabricate a prototype;
- create a product demonstrating the application of technological processes;
- use tools and procedures safely;
- forecast trends in new and emerging technologies (alternative energy sources) and their potential impacts;
- explore future labor market trends and educational needs; and
- investigate space industrialization.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I – INTRODUCTION TO TRANSPORTATION SYSTEMS

Unit Topics To Be Covered

1. What is transportation
2. Using transportation
 - a. Ways and Routes
 - b. Support facilities
 - c. Passengers and Cargo
 - d. Economic Value of Using Transportation
3. Parts of the Transportation System
4. Universal System Model
 - a. Inputs
 - b. Processes
 - c. Outputs
 - d. Feedback
 - e. Safety in the Laboratory

Unit Goal: Students will develop a general understanding of transportation Systems. This encompasses defining transportation, describing how transportation is used, and identifying the parts of a transportation system.

Learner Outcomes

The students will:

- define transportation;
- describe how transportation is used to provide services;
- explain how transportation affects the economic value of products;
- name the parts of transportation systems; and
- identify positive and negative impacts of transportation.

Suggested Classroom Illustrations

- *Research one of the four environments of transportation. Write a short paper describing the history and technological advancements in that area.
- Invite an individual from a transportation company to speak about transportation.
- With students in class, write out and develop various plans to transport a person from one place to another of their choice (at least 3000 miles apart). Class discussion on the transportation methods involved and why they were chosen.

Transportation Systems Curriculum (Cont'd)
Unit I (Cont'd)

Suggested Classroom Illustrations (Cont'd)

- Packaging problem; have students design by teams, a package for an egg that will sustain a four-foot drop without breakage. Discuss the relationship of packaging to transportation (air bags, bumper design, retaining systems on roadways, etc).
- Demonstrate the various technologies in the lab – available as tools to study transportation.
- *Observe and list several transportation vehicles and safety considerations associated with their operation or use.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook
- Hands on Project – Using the assigned rubric, students will create a transportation device and identify components of the Universal Systems Model
- Apply Safety in the Laboratory/Safety test

Supplemental Activities and Resources

- Transportation Technology student resource books
- Lessons with PowerPoint presentation
- Handouts
- Worksheets and rubrics
- Internet

UNIT II – ENERGY

Unit Topics To Be Covered

1. Sources of Energy
 - a. Renewable Energy
 - b. Nonrenewable Energy
 - c. Inexhaustible Energy
2. Energy Conversion
 - a. Law of Conservation of Energy
 - b. Forms of Energy
3. Using Energy in Transportation Systems

Unit Goal: Students will explore and become familiar with forms of energy, conversion of energy, and our dependence on energy in transportation systems.

Learner Outcomes

The students will:

- define energy and work;
- identify sources of energy;
- demonstrate how potential energy is used in a transportation system;
- identify the major sources of energy for the United States;
- list and describe six forms of energy; and
- understand the different uses of energy in transportation.

Suggested Classroom Illustrations

- Allow students to setup and run a Sterling Engine.
- Use parabolic reflector to run an engine.
- Use solar voltaic collector to run an electric motor.
- Run transparent internal combustion engine.
- *Measure horsepower of students climbing stairs.
- *Brainstorm and problem solve – effects of oil shortages in East Haddam.
- Build a mousetrap transportation system.
- Build a balloon powered transportation system to carry an object from point A to point B.
- Set up a wind generator and create an electric circuit.
- *Complete unit Activity Design Report.

Transportation Systems Curriculum (Cont'd)
Unit II (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit.
- Activity based Projects – Using the assigned rubric, students will create a transportation device and demonstrate the conversion of potential to kinetic energy.
- Apply Safety in the Laboratory .

Supplemental Activities and Resources

- Lessons with PowerPoint presentation
- Teacher's Resource Binder
- Handouts
- Worksheets
- Lab Module Units
- Student Resource Books
- Internet and Library

UNIT III – LAND TRANSPORTATION SYSTEMS

Unit Topics To Be Covered

1. Introduction to land transportation
2. Historical perspective on land transportation
3. Body/frame systems typically used on land transportation
4. Propulsion systems typically used on land transportation
5. Suspension systems typically used on land transportation
6. Control systems typically used on land transportation
7. Guidance systems typically used on land transportation
8. Support systems typically used on land transportation
9. Careers in land transportation
10. Aerodynamics

Unit Goal: Students will explore and learn about land transportation systems, the subsystems, and potential career opportunities.

Learner Outcomes

The students will:

- identify the transportation sub-systems of body/frame, propulsion, suspension, control, guidance and support relating to land transportation vehicles;
- describe several occupations that are associated with land transportation systems;
- identify forces acting upon a land vehicle;
- describe how gases and liquids flow around an object;
- describe the terms laminar flow and drag coefficient; and
- apply safety regulations in the laboratory.

Suggested Classroom Illustrations

- *In essay form, identify six sub systems of a land transportation system and identify one career opportunity in each. Choose one career and describe education and training needed.
- Test vehicles in a wind tunnel.
- Design, fabricate, test and evaluate a land transportation system.
- Explore and experiment with traditional and alternative fuels.
- Develop a design, construct and test a CO₂ powered vehicle in accordance with the TSA competition rules.

Transportation Systems Curriculum (Cont'd)
Unit III (Cont'd)

Suggested Classroom Illustrations (Cont'd)

- Develop a design, construct and test a maglev vehicle in accordance with the instructors specifications.
- *Complete unit Activity Design Report.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit.
- Activity based Projects – Using the assigned rubric, students will create a transportation vehicle applying knowledge of forces and aerodynamics.
- Apply Safety in the Laboratory.

Supplemental Activities and Resources

- Lessons with PowerPoint presentation
- Teacher's Resource Binder
- Handouts
- Worksheets
- Lab Module Units
- Student Resource Books
- Internet and Library

UNIT IV – AIR TRANSPORTATION SYSTEMS

Unit Topics To Be Covered

1. Introduction to aircraft and flight
2. Historical perspective on atmospheric transportation
3. Lighter-than-air and heavier-than-air systems
4. Body/frame systems typically used on atmospheric transportation
5. Propulsion systems typically used on atmospheric transportation
6. Suspension systems typically used on atmospheric transportation
7. Control systems typically used on atmospheric transportation
8. Guidance systems typically used on atmospheric transportation
9. Support systems typically used on atmospheric transportation
10. Theory of flight (Bernoulli principle and related Newton's laws of motion)
11. Careers in air transportation

Unit Goal: Students will explore and learn about air transportation systems, theory of flight, and potential career opportunities.

Learner Outcomes

The students will:

- give examples of air transportation systems;
- describe how control surfaces work on aircraft;
- explain how aircraft fly and identify the scientific principles;
- discuss the economic impacts of the air transportation industry; and
- describe several occupations that are associated with air transportation systems.

Suggested Classroom Illustrations

- Visit workers in aircraft construction and/or maintenance to learn what skills are needed for employment in these occupations.
- Conduct experiments with lift and drag using wind tunnel and various model wing sections.
- Make and fly different types of airplanes. Trim each for flight.
- Make and fly a hand launched glider from a kit.
- Design a model or mock-up to illustrate the effects of control surfaces.
- *Prepare an occupational list and discuss the education and training needed for people in these jobs.
- *Research the history of flight and write a report on findings.

Transportation Systems Curriculum (Cont'd)
Unit IV (Cont'd)

Suggested Classroom Illustrations (Cont'd)

- Arrange a field trip to a local airport hanger to observe service personal and service operations.
- Build and fly a model hot air balloon using appropriate safety procedures.
- Design and build a Co2 airplane.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit.
- Activity based Projects – Using the assigned rubric, students will create a transportation vehicle applying knowledge of forces and aerodynamics.
- Apply Safety in the Laboratory.

Supplemental Activities and Resources

- Lessons with PowerPoint presentations
- Teacher's Resource Binder
- Handouts
- Worksheets
- Lab Module Units
- Student Resource Books
- Internet and Library
- Wind Tunnel

UNIT V – SPACE TRANSPORTATION SYSTEMS

Unit Topics To Be Covered

1. Introduction to rockets
2. Historical perspective on space transportation
3. Body/frame systems typically used on space transportation
4. Propulsion systems typically used on space transportation
5. Suspension systems typically used on space transportation
6. Control systems typically used on space transportation
7. Guidance systems typically used on space transportation
8. Support systems typically used on space transportation
9. Newton's Laws of Motion
10. Careers in space transportation

Unit Goal: Students will explore and learn about space transportation systems, the history of space flight, and potential career opportunities.

Learner Outcomes

The students will:

- build and experiment with model space transportation systems;
- design, fabricate, test and evaluate a space transportation system;
- identify and describe the historical innovations in the evolution of space transportation systems, and their impact on our society, economy and environment;
- identify the transportation sub-systems of body/frame, propulsion, suspension, control, guidance and support relating to space transportation vehicles;
- describe several occupations that are associated with space transportation systems;
- identify and describe the principles of physics associated with movement in space and travel to and from space; and
- apply safety regulations in the laboratory.

Suggested Classroom Illustrations

- Build models of historically based rockets (Saturn V, etc).
- *Have students request some needed information for their studies from NASA.
- Investigate the life support systems - shuttles and other manned space craft.
- Build a fuel or solar cell to produce energy.
- Plot the path of a spacecraft as it orbits the earth.

Transportation Systems Curriculum (Cont'd)
Unit V (Cont'd)

Suggested Classroom Illustrations (Cont'd)

- *Build and launch a model rocket using all appropriate safety procedures - determine altitude and speed.
- Research solid and liquid rocket fuels and compare and contrast the differences in regard to power, weight and safety.
- Thrust measurement activity. A student wearing roller skates will throw a 5-pound, 10-pound and a 20-pound bag of sand. Measurement of his counter motion will demonstrate Newton's law of motion.
- *Measure thrust of a model rocket engine.
- *Complete unit Activity Design Report.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit.
- Activity based Projects – Using the assigned rubric, students will build a model rocket, test for flight stability, launch and determine altitude and speed of vehicle. Create a PowerPoint presentation on a historical component of space transportation.
- Apply Safety in the Laboratory.

Supplemental Activities and Resources

- Lessons with PowerPoint presentations
- Teacher's Resource Binder
- Handouts
- Worksheets
- Lab Module Units
- Student Resource Books
- Internet and Library
- Wind Tunnel

UNIT VI – MARINE TRANSPORTATION SYSTEMS

Unit Topics To Be Covered

1. Introduction to marine transportation
2. Historical perspective on marine transportation
3. Body/frame systems typically used on marine transportation
4. Propulsion systems typically used on marine transportation
5. Suspension systems typically used on marine transportation
6. Control systems typically used on marine transportation
7. Guidance systems typically used on marine transportation
8. Support systems typically used on marine transportation
9. Careers in marine transportation

Unit Goal: Students will explore and learn about marine transportation systems, the history, and potential career opportunities in marine related industries.

Learner Outcomes

The students will:

- build and experiment with model marine transportation systems;
- design, fabricate, test and evaluate a marine transportation system;
- identify and describe the historical innovations in the evolution of marine transportation systems, and their impact on our society, economy and environment;
- identify the transportation sub-systems of body/frame, propulsion, suspension, control, guidance and support relating to marine transportation vehicles;
- describe several occupations that are associated with marine transportation systems; and
- apply safety regulations in the laboratory.

Suggested Classroom Illustrations

- Study a chart of the U.S. coastal and inland waterways and trace the various major inland routes.
- Locate the Intercoastal Waterway routes on a chart.
- *Compute how much time and money can be saved when shipping goods from New York to San Francisco through the Panama Canal.
- Build a model of an air cushion vehicle.
- Using a model boat, experiment with hull trim and stability by varying the mass and load distribution and movements of the boat.

Suggested Classroom Illustrations (Cont'd)

- Demonstrate rolling, pitching, and yawing with a model boat in a hydro test tank.
- *Plot a course with corrections for current flow and tide.
- Arrange a field trip to a marine facility to observe and discuss marine design .
- Using one square foot of aluminum foil each student will design a hull that will be used in a competition for carrying plastic golf balls.
- Invite a representative from a Marine transportation business to speak at the class.
- Compare the specific differences between a marine gasoline engine and a land use gasoline engine.
- Compare and contrast the differences between marine and land transportation safety systems.
- *Using computer design software, students will design hulls and determine weight carrying capability and perform buoyancy calculations.
- *Complete unit Activity Design Report.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit.
- Activity based Projects – Using the assigned rubric, students will build a model boat, experiment with hull trim and stability by varying the mass and load distribution and movements of the boat.
- Apply Safety in the Laboratory.

Supplemental Activities and Resources

- Lessons with PowerPoint presentations
- Teacher's Resource Binder
- Handouts
- Worksheets
- Lab Module Units
- Student Resource Books
- Internet and Library
- Hydrodynamic test tank

PRINT AND MEDIA RESOURCES

Reference Books:

Exploring Transportation, Stephen Johnson/Patricia Farrar-Hunter, The Goodheart-Wilcox Company, Inc., Tinley Park, Illinois, © 2002

Software:

Mastercam Version 9.1 Mill, Copyright © 2002, CNC Software, Inc., Tolland, CT

Mastercam Version 9 Router, Copyright © 2002, CNC Software, Inc., Tolland, CT

SpectraLight Mill Control Software, Intelitek, Inc., Manchester, NH

SpectraLight Router Control Software, Intelitek, Inc., Manchester, NH

SpectraLight Mill Control Software, Intelitek, Inc., Manchester, NH

Microsoft Office 2000, Microsoft Corporation, Redmond, WA, 2000

Adobe PhotoShop, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 2002

West Point Bridge Designer 2003, West Point Military Academy

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, learning within a module, group discussion, individualized tutoring, peer instruction, and mentoring.

Instructional Materials:

Layout equipment, CNC Router, CNC Mill, tools, computers and software, LCD projector, Design Activity Report packet, color printers, paper, Lab equipment, machining stock and safety supplies appropriate to each unit.

COMPUTER INTEGRATED MANUFACTURING CURRICULUM

Introduction

This course is open to all students with an interest in Computer Integrated Manufacturing, the backbone of modern manufacturing systems. The course exposes students to the fundamentals of computerized manufacturing technology. Study is centered on the key concepts of CAD/CAM software and converting computer generated geometry into a program to drive CNC machines.

Students use CNC machines to produce actual models of three-dimensional designs in wood, plastic and metal. The course will be taught using demonstration and discussion combined with individual and team-centered project based learning. This course is recommended to students considering future careers in engineering or any of the trade fields.

Curriculum Contents

This curriculum is divided into eleven units of study:

Unit I – Understanding the rationale and history of CIM.

Unit II – Understanding and navigating through CAD/Cam (Mastercam) software.

Unit III – Creating 2D CAD geometry

Unit IV – Creating 2D toolpaths in Mastercam

Unit V – Knowing machine components and their safe use.

Unit VI – Understanding the Cartesian coordinate system and its application in CNC Machining.

Unit VII – Setting up and machining a 2D product.

Unit VIII – Understanding basic NC Programming and Editing

Unit IX – Creating 3D CAD Geometry

Unit X – Creating 3D toolpaths using Mastercam software.

Unit XI – Setting up and machining a 3D product.

Each unit contains:

- Applicable performance standards adapted from the Connecticut Technology Education Curriculum Framework
- The unit goal
- Learner outcomes
- Suggested classroom illustrations
- Suggested unit evaluation/assessment activities
- Supplemental activities and resources

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- evaluate technologies based on their positive and negative outcomes;
- identify career opportunities in the areas of transportation, communications, production and biotechnology;
- produce products with raw and recycled materials by separating, forming, combining, and finishing;
- operate a computer-aided drafting (CAD) system;
- describe computer-integrated manufacturing;
- generate and operate a computer numerical control (CNC) program;
- generate a computer image of an object in 3D format;
- demonstrate an ability to safely and accurately use the layout, form, separate, combine, treat and finish tools and processes in manufacturing a product;
- demonstrate an ability to complete a detail design for any given embodiment design; and
- apply a variety of creativity-enhancing techniques in completing a conceptual, embodiment and detail design solution.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I – UNDERSTANDING THE RATIONAL AND HISTORY OF COMPUTER INTEGRATED MANUFACTURING

Unit Goal: Students will examine the historical progression of manufacturing processes from the pre-industrial revolution period, to present day computer integrated manufacturing.

Learner Outcomes

The students will:

- differentiate between manual operated and computer controlled machinery and their applications;
- create a historical timeline of manufacturing; and
- identify employment opportunities and impacts of CIM.

Suggested Classroom Illustrations

- Use the Internet to research the history of manufacturing.
- PowerPoint presentation/lesson on the history and development of manufacturing technology.
- Create a timeline display of Computer Numeric Control machinery.
- Classroom discussion of employment opportunities and impacts of CIM.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by assigning review questions.
- Test – At the end of this unit, have students answer questions on key historical information.
- Hands on Project – Create a timeline on the history of manufacturing processes.

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Worksheets
- Internet
- Classroom resource textbooks

UNIT II – UNDERSTAND AND NAVIGATE THROUGH CAD/CAM (MASTERCAM) SOFTWARE.

Unit Goal: Students will explore and become familiar with the Mastercam software layout, menu system, and Job Setup process.

Learner Outcomes

The students will:

- put to use the main and secondary menu, toolbar, and prompt line;
- create a Job Setup; and
- display the (x,y,z) origin.

Suggested Classroom Illustrations

- Practice moving through the menu system of Mastercam accompanied by computer Projection by instructor.
- Examine the toolbar and its applications.
- Use three methods of creating a Job Setup.
- Explore the uses of displaying the screen origin.
- Create a network folder for assignments.
- Class demonstrations.

Suggested Unit Evaluation/Assessment

- Evaluate understanding through class participation, skill demonstration, drawing assignments as observed by instructor.
- Hands on project – Students will create a simple drawing and Job setup. It will be saved in network assignment folder for evaluation. (Graded according to rubric)

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Worksheets
- Help menu in Mastercam

UNIT III – CREATE 2D CAD GEOMETRY

Unit Goal: Students will learn how to create 2D geometry, make changes, and move entities in a CAD drawing.

Learner Outcomes

The students will:

- create basic 2D geometry (lines, arcs, rectangles, polygons);
- modify geometry (fillet, trim, break, join); and
- Xform geometry (mirror, rotate, scale, translate, offset).

Suggested Classroom Illustrations

- Sequential lessons – instructor's computer monitor projected on screen.
- Completion of 10 chronological drawings 2D geometry.
- Cooperative student projects.
- Independent student projects.
- Class demonstrations.

Suggested Unit Evaluation/Assessment

- Evaluate understanding through printout of drawings.
- Completion of portfolio packet.
- Quiz – students will be given a drawing to complete (Graded according to rubric).

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Worksheets
- Help menu in Mastercam

UNIT IV – CREATE 2D TOOLPATHS IN MASTERCAM

Unit Goal: Students will learn the process of creating toolpaths using CAD geometry and verifying the part using solid modeling and back plot verification processes.

Learner Outcomes

The students will:

- select geometry for toolpath;
- create Job Setup;
- create Contour toolpath;
- create Pocket toolpath;
- create Drill toolpath;
- create Engraving toolpath;
- modify toolpath parameters;
- verifying the program using solid modeling and back plot; and
- post processing the file.

Suggested Classroom Illustrations

- Sequential lessons - instructor's monitor projected on screen.
- Creating toolpaths from 2D geometry lessons.
- Students working cooperatively.
- Creating a picture frame program.
- Creating toolpaths from assigned drawings.
- Producing setup sheet.
- Class demonstrations.

Suggested Unit Evaluation/Assessment

- Evaluate understanding through toolpath setup sheets.
- Monitoring student progress.
- Quiz to include toolpaths and verification print out.

Computer Integrated Manufacturing Curriculum (Cont'd)
Unit IV (Cont'd)

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Worksheets
- Help menu in Mastercam
- Create drawing and toolpaths for picture frame project

UNIT V - KNOW MACHINE COMPONENTS AND THEIR SAFE USE

Unit Goal: Students will identify and know the purpose of components on CNC machinery and demonstrate an understanding of safety procedures.

Learner Outcomes

The students will:

- learn and demonstrate Safety Rules for operating CNC router, mill, and lathe;
- pass test on machine Safety Rules; and
- identify machine hardware components.

Suggested Classroom Illustrations

- Introduction to machines.
- Safety responsibilities.
- Identification and use of emergency controls on machines.
- Complete machine component worksheets.
- Read machining information.
- View safety procedures on SpectraLight CD.
- Class demonstrations.

Suggested Unit Evaluation/Assessment

- Evaluate understanding through lab worksheets.
- Monitoring student lab work.
- Safety test.

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Worksheets
- Create drawing and toolpaths for picture frame project
- Help menu in Mastercam
- SpectraLight software safety program

UNIT VI – UNDERSTAND THE CARTESIAN COORDINATE SYSTEM AND ITS APPLICATION IN CNC MACHINING

Unit Goal: Students will apply the Cartesian coordinate system to their work and relate the importance of the system to the setup in CNC machining.

Learner Outcomes

The students will:

- understand coordinate system;
- understand absolute and incremental programming;
- plot both positive and negative coordinates in their correct quadrants; and
- demonstrate a basic knowledge of how coordinate systems are applied to machining tasks.

Suggested Classroom Illustrations

- Activity worksheets.
- Right hand rule.
- Theory of René Descartes' coordinate system.
- Sketch sheets.
- Vocabulary sheet.

Suggested Unit Evaluation/Assessment

- Evaluate understanding through monitoring student work.
- Worksheet assignments.
- Application of information to projects.
- And quiz.

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Class demonstrations
- Worksheets
- Help menu in Mastercam

UNIT VII – SETUP AND MACHINE A 2D PRODUCT

Unit Goal: At the end of this unit, students will be able to check their program and correctly secure stock prior to machining a part.

Learner Outcomes

The students will:

- select and size the work piece in the control program;
- change settings in verification window;
- install clamps on the hold-down table; and
- mount a work piece.

Suggested Classroom Illustrations

- Work in control program simulations.
- Install fixtures and clamping devices on machines.
- Secure stock on machine.
- Setup and run project program.

Suggested Unit Evaluation/Assessment

- Evaluate student understanding through observation.
- Printout of verification settings.
- Quality of products produced within specified tolerances.

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Class demonstrations
- Worksheets
- Help menu in Mastercam
- Machinist Handbook
- Machine Picture frame

UNIT VIII – UNDERSTAND BASIC NC PROGRAMMING AND EDITING

Unit Goal: At the end of this unit students will be able to write, check, and edit a numeric control program.

Learner Outcomes

The students will:

- understand numerical control programming;
- recognize NC words and their components; and
- detect errors in NC code blocks.

Suggested Classroom Illustrations

- Complete programming worksheets.
- Read for information using reference sheets.
- Sketch a simple part.
- Write a simple NC program.
- Locate mistakes in simple programming blocks.

Suggested Unit Evaluation/Assessment

- Evaluate understanding through worksheets.
- Simulate hand written NC program using verify software (graded according to rubric).
- Observation of student work.

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Class demonstrations
- Worksheets
- Help menu in Mastercam
- G and M code definition handout sheet

UNIT XI – CREATE 3D CAD GEOMETRY

Unit Goal: Students will understand how to create basic 3D geometry and utilize surface creation.

Learner Outcomes

The students will:

- understand construction planes and graphic views;
- create basic 3D wireframe geometry; and
- create ruled, swept, and lofted surfaces.

Suggested Classroom Illustrations

- Instructor's lessons projected from computer.
- Follow-along assignments.
- Cooperative student projects.
- Individualized problem solving.
- Obtaining information from instructional software.
- Machining 3D products demonstration.

Suggested Unit Evaluation/Assessment

- Evaluate understanding by monitoring student work.
- Project assignments.
- Setup sheet reports.
- Quality of products.

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Class demonstrations
- Worksheets
- Help menu in Mastercam

UNIT X – CREATE 3D TOOLPATHS USING MASTERCAM SOFTWARE

Unit Goal: Using 3D geometry, students will create 3D toolpaths to create and verify a product.

Learner Outcomes

The students will:

- create Surface Finish toolpaths;
- project a Contour toolpath onto a surface; and
- verify machining processes.

Suggested Classroom Illustrations

- Instructor's lessons and demonstration projected from computer.
- Student worksheets.
- Cooperative student projects.
- Verification of work using verify software.

Suggested Unit Evaluation/Assessment

- Evaluate understanding by monitoring student work.
- Project assignment.
- Setup sheet reports.
- Success of verification process.

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Class demonstrations
- Worksheets
- Help menu in Mastercam

UNIT XI – SETUP AND MACHINE A 3D PRODUCT

Unit Goal: Students will create, setup and machine a final 3D part using skills acquired in this course.

Learner Outcomes

The students will:

- correctly and safely setup machine to process stock;
- choose correct cutting tools for process;
- run 3D machining program; and
- effectively use finishing and assembly processes to complete project.

Suggested Classroom Illustrations

- Review safe setup of machines.
- Student project assignment.
- Machine setup report.
- Finish and assembly instructions.
- Machining products.

Evaluation

- Evaluate understanding through monitoring student work.
- Project assignment.
- Setup sheet report.
- Final project (assessed according to rubric).
- Portfolio packet.

Supplemental Activities and Resources

- Mastercam resource books
- Handouts
- Class demonstrations
- Worksheets
- Help menu in Mastercam
- Project samples
- Materials

PRINT AND MEDIA RESOURCES

Books:

CNC Programming Handbook, Peter Smid, Industrial press Inc., 200 Madison Avenue, New York, New York 10016-407, Copyright © 2000

Machine Tool and Manufacturing Technology, Steve F. Krar, Mario Raposarda, Albert f. Check, Delmar Publishers, 2 Columbia Circle, Box 15015, Albany, New York, Copyright © 1998

CNC Technology Student Activities Book, Revision B, September 2000, Intelitek, Manchester, NH

Manufacturing Systems, R. Thomas Wright, The Goodheart-Willcox Company, Inc., Tinley Park, Illinois, Copyright © 2000

Mastercam Version 9 Mill/Design Tutorial, Copyright © 2002, CNC Software, Inc.

Software:

Mastercam Version 9.1 Mill, Copyright © 2002, CNC Software, Inc., Tolland, CT

Mastercam Version 9 Router, Copyright © 2002, CNC Software, Inc., Tolland, CT

Mastercam Quickpart Version 9, Copyright © 2003, CNC Software, Inc., Tolland, CT

SpectraLight Mill Control Software, Intelitek , Inc., Manchester, NH

SpectraLight Router Control Software, Intelitek , Inc., Manchester, NH

SpectraLight Mill Control Software, Intelitek , Inc., Manchester, NH

SpectraLight Lathe Control Software, Intelitek , Inc., Manchester, NH

Microsoft Office 2000, Microsoft Corporation, Redmond, WA, 2000

Adobe PhotoShop, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 2002

Computer Integrated Manufacturing Curriculum (Cont'd)

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, learning within a module, group discussion, individualized tutoring, peer instruction and mentoring.

Instructional Materials:

Layout equipment, CNC Router, CNC Mill, CNC Lathe, computers and software, Portfolio Packet, color printers, paper, machining stock and safety supplies appropriate to each unit.

Portfolio Artifacts

1. Unit tests
2. Unit Portfolio Packets
3. Key chain
4. Picture frame project
5. Card Box project
6. Electrathon Sprocket
7. Chess pieces
8. Student created products (Instructor Approval needed)
9. Skateboard deck mold
10. Checker injection mold
11. CNC CO2 Car
12. Paperweight

MANUFACTURING CURRICULUM

Introduction

Manufacturing is important to every citizen; it impacts all individuals and nations. In this introductory course, we will study the processes of custom manufacturing, mass production, robotics, automation, and the impacts on our society.

Students will learn engineering concepts and apply them to product development using hands-On activities. Emphasis will be on the safe operation of hand tools, basic machinery, and Computer Numerical Control machinery to produce a wide range of products.

Curriculum Contents

This curriculum is divided into five units of study:

Unit I – Introduction to Manufacturing Systems

Unit II – Manufacturing and Society

Unit III – Materials, Measuring, and Layout

Unit IV – Manufacturing Processes

Unit V – The Design Process

Each unit contains:

- Applicable performance standards adapted from the Connecticut Technology Education Curriculum Framework
- The unit goal
- Learner outcomes
- Suggested classroom illustrations
- Suggested unit evaluation/assessment activities
- Supplemental activities and resources

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- critically analyze a given technology against a perceived need or want;
- use the systems model to analyze a complex technological system;
- describe the evolution of a technological system and its influence on the economy, culture, society and environment;
- identify and explore career opportunities in the areas of technology;
- investigate multiple solutions to a design problem;
- select appropriate technical processes and fabricate a prototype;
- create a product demonstrating the application of technological processes;
- use tools and procedures safely;
- select appropriate tools and procedures for a given task;
- forecast trends in new and emerging technologies and their potential impacts;
- explore future labor market trends and educational needs;
- describe and evaluate how society's expectations drive technological development;
- document a design to facilitate replication
- compare the techniques used to extract raw materials; and
- identify and describe methods used in manufacturing products.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I – INTRODUCTION TO MANUFACTURING SYSTEMS

Unit Topics To Be Covered

1. What is manufacturing? (PPT lesson)
2. Components of manufacturing
3. Changes in manufacturing
4. Free enterprise system
5. Safety in the laboratory

Unit Goal: To help students understand the manufacturing system and its impact on their lives.

Learner Outcomes

The students will:

- define manufacturing;
- describe how manufacturing developed;
- name the three basic types of modern production systems;
- explain how manufacturing and the economy influence each other;
- describe the four parts of a managed production system; and
- use basic hand and power tools.

Suggested Classroom Illustrations

- Describe the parts of a manufacturing system (PPT Lesson) with note/study sheet.
- Identify the basic manufacturing resources and processes using internet resources.
- Identify and describe the two basic methods of production giving examples from the internet.
- Describe the effects of free enterprise of manufacturing in U.S.
- Create a safety information sheet for one machine in the technology lab.
- Read information from resource book on Manufacturing Systems.
- Lab safety (PPT Lesson) with note/study sheet.

Manufacturing Curriculum (Cont'd)
Unit I (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubric, students will use problem-solving skills to work together in small groups to complete a manufacturing task.
- Apply Safety in the Laboratory/Safety test.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets
- Worksheets and rubrics
- Internet resources

UNIT II - MANUFACTURING AND SOCIETY

Unit Topics To Be Covered

1. Industrial Revolution
2. The role of modern manufacturing and social impacts
3. Computers in manufacturing
4. Industrial robots

Unit Goal: To give students an understanding of the exponential rate of change in manufacturing from the Industrial Revolution to the present and the resulting social impacts.

Learner Outcomes

The students will:

- describe the impact of the Industrial Revolution on society;
- identify several pioneers of the manufacturing industry;
- understand the development and growth of the manufacturing industry;
- list several ways in which industry has affected modern society; and
- identify employment opportunities in modern manufacturing.

Suggested Classroom Illustrations

- Describe the changes during the Industrial Revolution.
- Make a chart showing the role of modern manufacturing and its social impacts.
- *Use Pro-Desktop engineering software to design a product.
- Use Mastercam software and CNC machines to mass-produce a product.
- Visit Durham Manufacturing (field trip).
- *Research employment opportunities in manufacturing (classified employment ads) and describe training and skills necessary for a specific job (essay).

Manufacturing Curriculum (Cont'd)
Unit II (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Reading for information – Students will read selected information from resource books and Internet and answer questions.
- Apply Safety in the Laboratory.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets
- Worksheets and rubrics
- Internet resources

UNIT III – MATERIALS, MEASURING, AND LAYOUT

Unit Topics To Be Covered

1. Common production materials
2. Measuring and layout procedures
3. Common units of measurements for different materials
4. Common measuring and layout tools

Unit Goal: Students will be familiar with common materials and methods of measuring and layout used in manufacturing.

Learner Outcomes

The students will:

- identify the properties, grades, and uses of common production materials;
- describe the purpose of materials research;
- create a drawing with accurate dimensions of a simple product;
- explain the purpose of measuring and layout procedures; and
- convert metric measurements to customary measurement and vice versa.

Suggested Classroom Illustrations

- *Make a drawing showing the measurement of a simple product.
- *Identify the common units of measurement of a simple product (metric and fractional).
- Identify common measuring and layout tools.
- *Convert fractional dimensions to metric dimensions.
- *Choose one job function in manufacturing processes and identify the measurement skills needed. (Essay)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubric, students will design and mass-produce a product using CNC machinery.
- Apply Safety in the Laboratory.

Manufacturing Curriculum (Cont'd)
Unit III (Cont'd)

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets
- Worksheets and rubrics
- Internet resources

UNIT IV - MANUFACTURING PROCESSES

Unit Topics To Be Covered

1. History of processing materials
2. Primary processing to create standard stock
3. Secondary processing to create products
 - a. Forming
 - b. Casting and molding
 - c. Separating
 - d. Conditioning
 - e. Assembling
 - f. Finishing

Unit Goal: Students will develop an understanding of and be able to select and use manufacturing technologies.

Learner Outcomes

The students will:

- list and describe the three stages of manufacturing;
- give examples of processes used in each stage of manufacturing;
- list and describe the six families of secondary manufacturing processes; and
- use appropriate manufacturing processes to make a product.

Suggested Classroom Illustrations

- Classroom discussion/lesson on processes (PPT).
- Perform cutting processes on a lathe.
- Perform cutting processes using milling metal or plastic.
- Perform cutting using saws of various types.
- Create a part using injection molding.
- Weld two pieces of metal together.
- Bond pieces of metal together by gluing, cementing, soldering, or brazing.
- Use various common fasteners such as rivets, screws, and bolts to attach metal parts.
- Read about manufacturing processes in technology education reference books.

Manufacturing Curriculum (Cont'd)
Unit IV (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubric, students will use manufacturing processes to produce a product, identify and describe processes in activity design portfolio report.
- Apply Safety in the Laboratory.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets
- Worksheets and rubrics
- Internet resources
- Lab tools and machines

UNIT V- THE DESIGN PROCESS

Unit Topics To Be Covered

1. Introduction and orientation to the design cycle
2. Defining the design process
3. Sketching and conceptual drawings
4. The importance of the research process
5. Prototypes

Unit Goal: Students will understand and apply the design process to develop multiple solutions to solve a manufacturing problem or satisfy a human need.

Learner Outcomes

The students will:

- identify a design opportunity;
- research the design opportunity;
- brainstorm possible solutions to a problem;
- define a problem or need;
- prepare conceptual drawings to communicate an idea;
- build a solution prototype;
- test, evaluate, and revise a solution; and
- communicate a design idea.

Suggested Classroom Illustrations

- Students re-think and re-engineer everyday items in classroom discussion.
- Brainstorm potential design opportunities in our everyday world.
- Redesign a paperclip.
- Redesign a backpack.
- Design a specialized bicycle.
- *Use Pro-Desktop software as a design tool.
- *Complete Activity Design Portfolio for related project.
- *Research product information, answer specific related open-ended questions.
- Use design notebook to draw various designs.

Manufacturing Curriculum (Cont'd)
Unit V (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through classroom review and discussions followed by written quizzes.
- Test – Students will read related design and engineering handouts and respond to questions from reading.
- Hands on Project – Using the assigned rubric, students will use design processes to communicate an idea to solve a specific manufacturing problem or need.
- Activity Design Portfolio Report.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets
- Worksheets and rubrics
- Internet resources
- Lab tools and machines

PRINT AND MEDIA RESOURCES

Reference Books:

Technology Today and Tomorrow, Sharon A. Brusic, Ed.D., James F. Fales, Ed.D., and Vincent F Kuetemeyer, Ed.D., Glencoe-McGraw-Hill, 3008 W. Willow Knolls Drive, Peoria, IL 61614

Software:

Mastercam Version 9.1 Mill, Copyright © 2002, CNC Software, Inc., Tolland, CT

Mastercam Version 9 Router, Copyright © 2002, CNC Software, Inc., Tolland, CT

SpectraLight Mill Control Software, Intelitek, Inc., Manchester, NH

SpectraLight Router Control Software, Intelitek, Inc., Manchester, NH

SpectraLight Mill Control Software, Intelitek, Inc., Manchester, NH

Microsoft Office 2000, Microsoft Corporation, Redmond, WA, 2000

Adobe PhotoShop, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 2002

West Point Bridge Designer 2003, West Point Military Academy

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, learning within a module, group discussion, individualized tutoring, peer instruction, and mentoring.

Instructional Materials:

Layout equipment, CNC Router, CNC Mill, tools, computers and software, LCD projector, Design Activity Report packet, color printers, paper, Lab equipment, machining stock and safety supplies appropriate to each unit.

GRAPHIC COMMUNICATIONS/DESKTOP PUBLISHING CURRICULUM

Introduction

This course is one of the Technology Education Electives designed to provide students with a general overview of Communications Technology as it is used daily in the world. The basic communications systems: data communications (computers), technical design, optic systems, graphic production, and audio/video systems will be covered. The program has both breadth and depth. Each system is discussed from the ground up, beginning with its scientific underpinnings, moving through equipment and operation, and ending with applications. Students are encouraged to discover not only how something works, but also the scientific basis for why it works. When students have completed the course, they will have been exposed to all the systems in enough detail that they should be able to discuss them with real understanding. This 1 credit course is open to all students in grades 9-12.

Curriculum Contents

This curriculum is divided into ten units of study:

Unit I – Understanding Communication Systems

Unit II – The Changing Nature of Communication Technology

Unit III – The Impact of Communication Technology

Unit IV – Message, Design, Composition and Assembly

Unit V – Introduction to Computer Systems

Unit VI – Computer Hardware

Unit VII – Computer Applications

Unit VIII – Message Transfer and Production Conversion

Unit XI – Audio Video Equipment

Unit X – Applications of Satellite, Laser and Fiber Optic Communication Systems

Each unit contains:

- Applicable performance standards adapted from the Connecticut Technology Education Curriculum Framework
- The unit goal
- Learner outcomes
- Suggested classroom illustrations
- Suggested unit evaluation/assessment activities
- Supplemental activities and resources

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- describe electronic publishing and give examples of this technology;
- demonstrate the proper use of the terminology associated with electronic publishing, graphic arts and computers;
- identify and describe component functions of a microcomputer electronic publishing system;
- apply accepted design principles of text and graphics to the layout of printed and electronically published materials;
- operate a computer and produce electronic publishing products using appropriate software;
- operate a digital camera to produce and modify a video image using appropriate software;
- operate a scanner and digitize a video image using appropriate software;
- demonstrate skills in marketing printed products;
- send and access information through a network;
- design and produce a video or multimedia production;
- capture a signal from an orbiting satellite;
- transfer information using laser transmission technology;
- communicate using fiber optic cables; and
- export and import images in a variety of file forms.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I – UNDERSTANDING COMMUNICATION SYSTEMS

Unit Topics To Be Covered

1. Universal Systems Model
2. Communication Systems Model
3. Communication Concepts
4. Modes of Communication
 - A. Human Communication
 - B. Animal Communication
 - C. Machine Communication
5. Types of Communication Systems
 - A. Data Communication
 - B. Technical Design
 - C. Optics
 - D. Graphic Production
 - E. Audio and Video
 - F. Integrated Systems
6. Research and Development
 - A. Problem Solving

Unit Goal: Students will examine the major communication technology systems covered in this course: data communication, technical design, optics, graphic production, audio & video systems and satellite, laser & fiber optic communication.

Learner Outcomes

The students will:

- explain the universal systems model and apply it to the different communications systems;
- explain the communication systems model, name its parts and apply it to the systems discussed in the chapter;
- identify the communications concepts;
- identify and use different modes of communication;
- list and give examples of the different types of communication systems; and
- list the steps in problem solving and tell why they are important.

Suggested Classroom Illustrations

- Have the students to use sheets of paper and colored markers to make a series of drawings that tell a story without using words, as a mode of communication.
- * Have the students to research other modes of communication and write an essay about the topic.
- * Have students to find ads from the “Help Wanted” section of the local newspaper, or the inter-net that relate to occupations in communications, and then create a report listing the skills, training, and future employment outlook for the positions.
- Have students to work in pairs or small groups and practice sending and receiving messages using sign language, Morse code, or one of the other modes of communication covered in this unit of study.

Suggested Unit Evaluation/Assessment

- Teacher observation of student’s mastery of information and skills during class participation and completion of assignments in the illustrations listed above.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using an assigned rubric, have the students layout and design 4 memo pads using paper, pencils and paste-up graphics.

Supplemental Activities and Resources

- Have students complete Section 1, Activity 1 in the Student Workbook.
- Materials from the Teacher’s Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT II – THE CHANGING NATURE OF COMMUNICATION TECHNOLOGY

Unit Topics To Be Covered

1. Contributions of the Past
2. The Information Age
3. Changes in Communication
 - A. Computerization
 - B. Miniaturization
 - C. Digitization
 - D. Integration
 - E. Computers in every home
4. Directions for the Future
 - A. Computers
 - Storage Media
 - Computer Networks
 - Online Databases
 - B. Technical Design
 - C. Optics
 - D. Graphic Production
 - E. Audio and Video

Unit Goal: Students will first examine the history of Communications: recent developments, such as computerization, miniaturization, digitization, and integration. Then they will focus on the new directions in which Communications seem to be moving.

Learner Outcomes

The students will:

- demonstrate an understanding of the history of communication and identify why our present time is referred to as the “Information Age”;
- identify what changes have occurred in communications because of computers;
- identify what historical developments have brought to the different communication systems; and
- list what new developments may be taking place in communications today.

Suggested Classroom Illustrations

- When discussing the material on computerization, open one of the computers in the classroom and explain the components inside and then demonstrate the various software programs the students will be using in this class.
- * Have the students to research the direction in which a mode of communication is moving (science magazines would be a good source of information, the inter-net) and write an essay on the information.
- * Have students write out note cards with information on what they are learning about optics, satellites, and communication in their science classes, and then orally report this to the rest of the class.
- Invite a representative from your local telephone company to speak to the class on fiber optics, satellite transmission, videoconferences, modems, etc.
- Conduct a field trip to ESPN.

Suggested Unit Evaluation/Assessment

- Teacher observation of classroom participation in assigned activities such as the research essay and the oral report.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using an assigned rubric, have the students use a basic computer program to create a finished product of the memo pads designed in the previous unit.

Supplemental Activities and Resources

- Have students complete Section 1, Activity 2 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT III – THE IMPACT OF COMMUNICATION TECHNOLOGY

Unit Topics To Be Covered

1. Technology Assessment
 - A. Categories of Impact
2. Political Impact
 - A. Politics and the Media
 - B. Satellite Communications
3. Social Impact
 - A. “Brave New World”
 - B. Education and Training
 - C. Information Storage and Retrieval
 - D. Leisure Time
4. Economic Impact
 - A. The World Economy
 - B. From a Production to a Service Economy
 - Use of credit
5. Environmental Impact
 - A. The Use of Paper
6. Cultural Impact
 - A. The Video Revolution
7. Ethical Issues
 - A. Digital Editing
 - B. Data Security

Unit Goal: Students will examine the different ways in which the Communication Technologies affect their lives and how our government attempts to assess the impacts. They will learn the categories impacts fall into and be able to give examples.

Learner Outcomes

The students will:

- demonstrate an understanding of technology assessment;
- explain the categories of impact and briefly describe them; and
- identify the six different categories of impact that relate to communications technology.

Suggested Classroom Illustrations

- * Have the students demonstrate their understanding of technology assessment by completing a simple assessment of an everyday item and writing a report.
- * Have the students choose on communication device and write a report on what effect the absence of the devices might have on their life?
- * Have students to record the amount of radio and TV time as well newspaper space that is given to one issue for one week. At the end of the week, have the students create a set of graphs and or charts illustrating the information and the ramifications of the attention paid to that issue.

Suggested Unit Evaluation/Assessment

- Quiz– At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Test – Student's completion of the assigned classroom illustrations.
- Hands on Project – Have the students use the scanning software to scan photographs brought in from home, for use in the creation of a photo album later in the course.

Supplemental Activities and Resources

- Have students complete Section 1, Activity 3 & 4 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT IV – MESSAGE DESIGN, COMPOSITION, AND ASSEMBLY

Unit Topics To Be Covered

1. Designing a Graphic Message
 - A. Principles of design
 - Rhythm
 - Balance
 - Proportion
 - Variety
 - Emphasis
 - Harmony
 - B. Design elements
 - C. Materials and Techniques
 - Typography
 - Measurement
 - Substrates
 - Layout sketches
 - Color systems
 - Computer design
2. Composing the Graphic Message
 - A. Typeset copy
 - Copy fitting
 - B. Illustrations
 - Line Art
 - Continuous-Tone Images
 - Full-Color Artwork
 - C. Desktop Publishing
3. Assembling the Graphic Message
 - A. Paste-up
 - B. Computerized Message Assembly

Unit Goal: Students will examine the first steps in the graphic design process, including ways in which the design is created, styles of type used, and color systems. Composition and assembly will also be covered, fonts, paste-ups and the importance of computerized message assembly and desktop publishing.

Learner Outcomes

The students will:

- list and describe the principles and elements of design;
- identify the steps required to design a graphic message;
- explain how a graphic message is composed and assembled; and
- describe how computers have changed the way in which graphic messages are created and produced.

Suggested Classroom Illustrations

- Have students collect examples of graphic designs and label them indicating the message that they are trying to convey.
- Have students create a color wheel using paints or colored markers and showing the three primary, three secondary and three tertiary colors.
- Have students create their own clip-art collection. They may collect drawings for magazines, create their own manually, or use the computer and a drawing program.
- Have students use a computer-drawing program and let them use it to illustrate the basic design elements.
- Have students complete a hand paste-up and a computerized message assembly.
- Have students create and assemble a graphic message using a desktop publishing system.
- * Have the students write an essay comparing the two ways of message assembly they used listed above.
- * Have the students write articles about various topics around the school and community and then publish a school newsletter or newspaper using desktop publishing software.

Suggested Unit Evaluation/Assessment

- Evaluate students' understanding through observation of class & lab participation.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using an assigned rubric Have the students design a professional looking event ticket and poster advertising the event using the skills presented in this area.

Supplemental Activities and Resources

- Have students complete Section 5, Activity 1 & 2 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT V – INTRODUCTION TO COMPUTER SYSTEMS

Unit Topics To Be Covered

1. The Types of Computers
2. How It All Started
 - A. Early Calculators
 - B. Computers Become Logical
 - C. The Tiny Transistor
 - D. The Birth of the Apple Computer
3. How Computers Work
 - A. The Binary System
 - B. Bits and Bytes
 - C. Microchips - The Basic Building Blocks
 - D. Putting It All Together
 - Buses
 - Ports
 - Peripherals
4. Operating Systems
 - A. Programming Languages and Software

Unit Goal: Students will examine the background information they will need in order to understand computers, including a brief history of computers, some basic computer science and the difference between digital and analog computers.

Learner Outcomes

The students will:

- demonstrate an ability to describe the history of computers;
- describe the basic operation of a computer;
- explain how microchips process information; and
- describe what a programming language is and name some of the common languages.

Suggested Classroom Illustrations

- Invite the school's computer network technician into the class to explain to the class how the LAN works and how the students may get involved in the Student Computer Tech. Program.
- * Have the students research a person, institution, or company involved with the designing and/or evolution of computer systems or software, and write a paper on their findings.
- Have students begin to use the classroom computers in more of their work. For example, students could start learning the more advanced desktop publishing and imaging programs used in the classroom.

Suggested Unit Evaluation/Assessment

- Quizzes – assess the student's mastery of information through the classroom assignments and a research paper.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using an assigned rubric, have the students, layout, design and produce a calendar for the upcoming year.

Supplemental Activities and Resources

- Have students complete Section 2, Activity 1 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT VI – COMPUTER HARDWARE

Unit Topics To Be Covered

1. Input Devices
 - A. Keyboards
 - B. Joysticks
 - C. Digitizing Tablets and Touch Pads
 - D. Mice and Trackballs
 - E. Touch Screens
 - F. Scanners
 - G. Voice Input
2. Output Devices
 - A. Monitors
 - B. Printers
 - Laser Printers
 - Solid Ink Color Printers
 - Ink Jet Printers
 - C. Plotters
 - D. Synthesizers
3. Storage Devices
 - A. Magnetic Storage Media
 - Floppy Disks
 - Hard Disks
 - Magnetic Tape
 - B. Optical Disks
 - CD-ROM Disks
 - CD-R Disks
 - CD-RW Disks
 - DVD Disks

Unit Goal: Students will examine the input, output, and storage devices commonly used today as well as the historical background and the operation of most of the computer hardware used in detail.

Learner Outcomes

The students will:

- identify input devices, such as mice and digitizing tablets, and tell briefly how they work;
- identify output devices, such as monitors and printers, and tell briefly how they work; and
- identify storage devices, such as floppy disks and optical disks, and tell briefly how they work.

Suggested Classroom Illustrations

- * Have the students research artificial intelligence, the use of computers for problem solving and decision-making. Ask them to identify a problem that might be solved using artificial intelligence. Have them compile a list of the facts and judgments necessary for the computer to be able to solve the problem.
- * Have the students research what can be done to keep computers safe from computer viruses. If some students have the programming capability, have them devise a virus-protection program. Otherwise, have them to write an article for the school newspaper, advising people on what to do about viruses.
- Ask a local programmer or computer repair expert to talk to the class about a career in the computer field. Have the person cover training needed and trends that may affect jobs in the future.
- * Have the students research virtual reality. (This is the use of hardware and software to create an environment that people can enter as though it were real. The user wears headgear or a glove in order to interact with the images that surround him or her. Virtual reality has many advantages. Architects, for example, can create three-dimensional versions of building designs and walk a customer through them.) Have the students write an essay about virtual reality and its possible impacts.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information by assigning an oral report describing one component of a computer system and its relationship to the whole system.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using an assigned rubrics, have the students work with the digital cameras to take various photographs and also use the Photo Shop software to enhance, crop and/or touch-up the photographs.

Supplemental Activities and Resources

- Have students complete Section 2, Activity 2 & 3 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT VII – COMPUTER APPLICATIONS

Unit Topics To Be Covered

1. Communicating with Computers
 - A. Changing Analog Signals to Digital Data
 - B. Data Transmission Channels
 - C. Computer Networks
 - Local Area Networks
 - Long Distance Networks
2. Uses for Computers
 - A. Business
 - Word Processing
 - Accounting
 - Database Management
 - Facsimile Transmission
 - B. Industry
 - Computer-Aided Design (CAD)
 - Computer-Aided Manufacturing (CAM)
 - Computer-Integrated Manufacturing (CIM)
 - Sensors and Feedback
 - Inventory Control
 - C. Consumer Services
 - “Credit Card” Systems
 - Videotex
 - D. Entertainment and Education
 - Arcade Games
 - Interactive Video

Unit Goal: Students will examine how analog signals are changed to digital data and how computers communicate with one another via different types of networks. The students will also examine the many Communication uses of computers in business, industry, consumer services, entertainment and education.

Learner Outcomes

The students will:

- explain how computers communicate with one another;
- identify different kinds of computer networks; and
- list several uses for computers in business, industry, consumer services, and entertainment and education.

Suggested Classroom Illustrations

- * Have the students research a career they are interested in and research how computers are used in that career field. Have them to determine if it would help their chances to learn more about computers and write an essay on their findings.
- Have the students design a tri-folded brochure related to computer networking computer inter-net communication or information on a business or industry utilizing computer systems.

Suggested Unit Evaluation/Assessment

- Evaluate students' understanding through observation of class & lab participation in the assignments listed in the classroom illustrations.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using an assigned rubric, have the students layout and design advertisement pages.

Supplemental Activities and Resources

- Have students complete Section 2, Activity 4 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT VIII – MESSAGE TRANSFER AND PRODUCT CONVERSION

Unit Topics To Be Covered

1. Methods of printing
2. Offset Lithography
 - A. Offset Plates
 - B. Offset Lithographic Message Transfer
 - Inking
 - Dampening
 - Feeding
 - Registration
 - Printing
 - Delivery
 - C. Multi-color Presses
 - D. Uses for Offset Lithography
3. Relief Message Transfer
 - A. Letterpress
 - B. Flexography
 - Flexographic Plates
 - Flexographic Message transfer
 - Uses for flexography
4. Gravure
 - A. Gravure Plates
 - B. Gravure Message Transfer
 - C. Uses for Gravure
5. Screen Printing
 - A. Screen Printing Stencils
 - Thermofax Stencils
 - Hand-cut stencils
 - Photographic Stencils
 - B. Screen Fabrics
 - C. Frames
 - D. Inks and Substrates
 - E. Transferring a Stencil Message
 - F. Uses for Screen Printing
6. Electrostatic Message Transfer
 - A. Electrostatic Plates
7. Ink Jet Message Transfer
8. Low-cost Duplication
9. Product Conversion
 - A. Embossing, Foil Stamping and Die Cutting
 - B. Thermography
 - C. Assembling and Binding
 - D. Folding, Drilling and Cutting

Unit Goal: Students will examine what happens during the printing of a product as well as the most commonly used processes. They will also learn about the uses for which the major printing processes are best suited, as well as conversion processes, such as cutting and binding.

Learner Outcomes

The students will:

- identify the major printing processes and explain how they work;
- identify what each of the major processes is best suited for and give examples; and
- explain how printed materials are converted into finished products and describe several methods.

Suggested Classroom Illustrations

- Have students to locate and bring to class examples of die cutting, embossing, foil stamping and thermo-graphics.
- * Have the students research the history and development of one of the methods of printing covered in this area of study a complete a research paper on the topic.
- Have students plan an 8-16 page booklet for personal use or information. Have them use the steps in problem solving to determine how the booklet will be done using the desktop publishing software.
- Have the students use the Page-Maker and Photo Shop programs to design photos with captions as in newspapers.

Suggested Unit Evaluation/Assessment

- Test student's mastery of information by completing the research paper related to the history of graphic communication.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using an assigned rubric, have the students layout and design their photo albums using both the scanned and digital photographs and printing the final product with the color printer.

Supplemental Activities and Resources

- Have students complete Section 5, Activity 5 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT IX – AUDIO AND VIDEO EQUIPMENT

Unit Topics To Be Covered

1. The Telephone
 - A. Telephone Transmission
 - B. Transmission Channels
 - Copper wire Channels, Optical Fiber Channels
 - Multiplexing, Atmospheric Transmission Channels Reception
2. The Radio
 - A. Radio Transmission
 - Microphones, Control Room, Amplifiers
 - Transmitter, Antennas
 - B. Transmission Channels
 - C. Reception
 - Speakers
3. Television
 - A. Television Transmission
 - Television Camera, Microphones, Control Room
 - Remote Telecasts, Antenna
 - B. Transmission Channels
 - C. Reception
 - Cathode Ray Tube
4. The Record Player
 - A. Recording the Message
 - B. Playing the Message
5. Audio Tape Recorders and Players
 - A. Recording the Message
 - B. Playing the Message
 - C. Digital Recording
6. Video Recorders and Players
 - A. Video Formats

Unit Goal: Students will examine the workings of the telephone, radio, television, disk player and other audio and video recording and playing equipment. They will also review the history of these items and the major parts of each device.

Learner Outcomes

The students will:

- explain how the telephone, radio, television, record players and audio and video tape recorder work, and identify their differences and similarities;
- explain what goes on behind the scenes in a television production; and
- present a brief history of some of the devices covered in the chapter.

Suggested Classroom Illustrations

- Have the students utilize the digital recording equipment and create a 30 second commercial about a local business or school event.
- * Have the students research the history and development of one of the audio or video equipment items covered in this area of study a complete a research paper on the topic.
- Using a walkie-talkie, have students determine its range with the aid of the GPS systems and use it to transmit Morse code.
- * Using the lab kits for single transistor radios or FM wireless microphones, have students complete the lab assignments supplied with the equipment and complete a report on the lab.

Suggested Unit Evaluation/Assessment

- Evaluate students' understanding through observation of class & lab participation.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using an assigned rubric, have the students produce a 20-slide Power Point presentation that will be presented to the class using the video equipment available in the classroom.

Supplemental Activities and Resources

- Have students complete Section 6, Activity 2 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

UNIT X – APPLICATIONS OF SATELLITE, LASER, AND FIBER OPTIC COMMUNICATION SYSTEMS

Unit Topics To Be Covered

1. Satellite Systems
 - A. Terminology
 - B. Reception & Transmission
 - C. System Operations
 - D. Economic and social impacts
 - E. Employment trends
2. Laser Systems
 - A. Terminology
 - B. Reception & Transmission
 - C. System Operations
 - D. Economic and social impacts
 - E. Employment trends
3. Fiber Optics Systems
 - A. Terminology
 - B. Reception & Transmission
 - C. System Operations
 - D. Economic and social impacts
 - E. Employment trends

Unit Goal: Students will examine how these Communication Systems work including, electronics, magnetism, wave frequency, types of transmission and reception as well as how they have impacted the world.

Learner Outcomes

The students will:

- explain how satellite, laser and fiber optics communication systems work, and identify their differences and similarities;
- explain what changes have occurred in communications because of these systems; and
- present a brief history of each of these systems and future trends.

Suggested Classroom Illustrations

- * Have the students research the history and development of one of the forms of communications covered in this area of study and complete a research paper on the topic.
- * Using a cellular phone, have the students determine its ability to connect to a cell at various locations inside and outside the building. Then create a graph and map of the area showing the results.
- * Using the lab kits for fiber optic, laser, and satellite communications systems, have the students complete the lab assignments supplied with the equipment and complete a report on the lab.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student's mastery of information through observation of lab participation and completion of assigned written work.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using assigned rubrics, have the students determine the location of, and connect to a satellite to receive transmitted signals. Have students use a Global Positioning System to map out various locations of the school's property. Have student continue to work on various desktop publishing projects using the skills they have learned during this course including Ad pages, comic strips, brochures, jewel case covers & comic strips as listed in the Portfolio Artifact list as well as similar projects that are asked of by the school programs and staff.

Supplemental Activities and Resources

- Have students complete Section 6, Activity 3 in the Student Workbook.
- Materials from the Teacher's Resource Binder, supplied with the textbooks from the publisher, related to this chapter, including: handouts, worksheets, and color transparencies.

PRINT AND MEDIA RESOURCES

Books:

Communication Technology, Today and Tomorrow, Mark Sanders, Glenco-McGraw-Hill, Peoria, IL, 1997 or most recent edition available.

Reference Books (as listed or the or most recent update available):

Adobe Advanced PageMaker, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 1996

Adobe PageMill, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 1996

Adobe Photo Shop, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 1996

Software (as listed or the or most recent update available):

Adobe PhotoShop 6, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 2002

Adobe PageMaker 7, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 2002

Adobe Page Mill 2, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 1996

Corel Presentation 9, Corel Corporation, Ottawa, Ontario, Canada, 1999

HP Deskscan Pro Scanning Software, Hewlett-Packard Company, Palo Alto, CA, 2001

Microsoft Office 2000, Microsoft Corporation, Redmond, WA, 2000

Omni Form 4, ScanSoft Inc., Peabody, MA, 1999

Print Shop Ensemble III, Broderbund Software Inc., Novato, CA, 1998

Graphic Communications/Desktop Publishing Curriculum (Cont'd)

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, learning within a module, group discussion, individualized tutoring, peer instruction and mentoring.

Instructional Materials:

Layout equipment, digital photography equipment, computers and software, color printers, audio module, satellite module, video equipment, paper and basic graphic supplies appropriate to each unit.

Glencoe Publishers, Teacher Resource Binder for Communication Technology Today and Tomorrow ISBN 0-02-677126-8, copyright 1997, or the most recent edition available.

Portfolio Artifacts

1. Memo pad
2. Greeting card
3. Event ticket & event poster
4. Brochure
5. Calendar for upcoming year
6. Photo album of scanned images
7. Ads pages
8. CD/DVD jewel case cover
9. Photo album of digital photos
10. 20 slide presentation
11. Comic strips

ENGINEERING AND PRODUCT DESIGN CURRICULUM

Introduction

(2 Semesters 1.0 Credit)

The first part of this course will focus on the fundamentals of engineering design. Students will apply engineering concepts to advanced projects in Computer Integrated Manufacturing. The course will be taught using demonstration and discussion combined with individual and team centered project based activities. Students will organize and operate an entrepreneurial business endeavor to market a product to raise funds for our Electrathon program.

Applying computer design and fabrication skills, students will then produce an advanced product such as an electric vehicle. Past projects (vehicles) will be modified tested and evaluated leading up to the final state competition.

This class not only teaches students manufacturing and fabrication skills, but also skills in teamwork, public relations, engineering, and report writing.

Curriculum Contents

This curriculum is divided into six units of study:

Unit I – Introduction to Transportation Systems

Unit II – Energy

Unit III – Land Transportation Systems

Unit IV – Air Transportation Systems

Unit V – Space Transportation Systems

Unit VI – Marine Transportation Systems

Each unit contains:

- Applicable performance standards adapted from the Connecticut Technology Education Curriculum Framework
- The unit goal
- Learner outcomes
- Suggested classroom illustrations
- Suggested unit evaluation/assessment activities
- Supplemental activities and resources

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- critically analyze a given technology against a perceived need or want;
- describe the transformation and conservation of kinetic and potential energy in mechanical, chemical and electrical systems;
- explore and describe how electricity is generated, transferred and used in modern technologies;
- use the systems model to analyze a complex technological system;
- describe the evolution of a technological system and its influence on the economy, culture, society and environment;
- identify and explore career opportunities in the areas of technology;
- investigate multiple solutions to a design problem;
- select appropriate technical processes and fabricate a prototype;
- create a product demonstrating the application of technological processes;
- use tools and procedures safely;
- forecast trends in new and emerging technologies (alternative energy sources) and their potential impacts;
- explore future labor market trends and educational needs; and
- investigate space industrialization.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I – INTRODUCTION TO PRODUCT DESIGN

Unit Topics To Be Covered

1. Introduction to product design
2. Identifying and defining design problems
3. Developing and evaluating product ideas
4. Engineering and specifying products
5. Analyzing solutions
6. Preparing ideas for managerial approval
7. Safety in the laboratory

Unit Goal: To help students learn how manufacturers identify and define a design problem, develop product ideas, engineer and specify products for manufacture, evaluate the proposed products, and present optimum solutions for approval.

Learner Outcomes

The students will:

- apply a systematic problem-solving strategy;
- conform to design criteria and constraints to engineer many possible solutions to solve a problem;
- communicate solutions;
- access results to narrow down solutions to one final choice; and
- safely choose and use basic hand tools and machines.

Suggested Classroom Illustrations

- Use hands-on activities to introduce students to the design process.
- Design a better paper clip.
- Design a Toothpaste Cap.
- Refine thumbnail sketch ideas into final drawings.
- Create a transporter to carry a clothespin from point A to B.
- Create a model from a drawing.
- *Dimension a product and communicate the information in a drawing.
- *Prepare a design brief/report for a product.
- Evaluate design solutions of various products.
- Complete safety worksheets.

Engineering and Product Design Curriculum (Cont'd)
Unit I (Cont'd)

Suggested Unit Evaluation/Assessment

- Quizzes/Reports and Presentations – Test student's mastery of information through classroom review and discussions followed by written quizzes, reports and PowerPoint presentations.
- Hands on Projects – As an action-based course, student understanding is assessed according to resulting design activities.
- Applying Safety in the Laboratory/Safety test.
- Authentic project and lab evaluation.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets to apply reading for information
- Worksheets and rubrics
- Internet resources

UNIT II – A SINGLE PROBLEM – MANY SOLUTIONS

Unit Topics To Be Covered

1. Accurate design concepts
2. Defining the problem
3. Design requirements
4. Design Specifications

Unit Goal: To investigate a product and observe the varied ways design requirements can be met.

Learner Outcomes

The students will:

- consider the relationship between form and function.

Suggested Classroom Illustrations

- Student or class will choose an object and discuss different ways of meeting established design criteria
- *Gather samples from the internet (photos) and describe how design relates to form and function
- *List the functions of an object; describe size, color, shape and materials in detail.
- Identify the conditions product is used

Suggested Unit Evaluation/Assessment

- Quizzes/Reports and Presentations – Test student's mastery of information through classroom review and discussions followed by written quizzes, reports and PowerPoint presentations.
- Hands on Projects – As an action-based course, student understanding is assessed according to resulting design activities.
- Applying Safety in the Laboratory/Safety test.
- Authentic project and lab evaluation.

Engineering and Product Design Curriculum (Cont'd)
Unit II (Cont'd)

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets to apply reading for information
- Worksheets and rubrics
- Internet resources

UNIT III – ELECTRICAL SYSTEMS

Unit Topics To Be Covered

1. Key concepts of electricity
2. Circuits
3. Conductors
4. Series and Parallel circuits
5. Measuring Electricity
6. Short circuits and fuses

Unit Goal: To prepare students for any electrical circuitry needed for later projects.

Learner Outcomes

The students will:

- identify key concepts of electricity;
- create and evaluate simple circuits;
- create a parallel circuit;
- create a circuit in series;
- measure volts, amps, and resistance; and
- check for continuity in a circuit.

Suggested Unit Evaluation/Assessment

- Quizzes/Reports and Presentations – Test student's mastery of information through classroom review and discussions followed by written quizzes, reports and PowerPoint presentations.
- Hands on Projects – As an action-based course, student understanding is assessed according to resulting design activities.
- Applying Safety in the Laboratory/Safety test.
- Authentic project and lab evaluation.

Engineering and Product Design Curriculum (Cont'd)
Unit III (Cont'd)

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets to apply reading for information
- Worksheets and rubrics
- Internet resources

UNIT IV – ENGINEERING FUNDAMENTALS

Unit Topics To Be Covered

1. Material classes
 - a. Metals
 - b. Ceramics
 - c. Polymers
 - d. Composites
2. Material properties
3. Material applications

Unit Goal: To have students build familiarity with material classes, material properties, and how materials are selected and used.

Learner Outcomes

The students will:

- define metals, ceramics, polymers, and composites;
- give examples of the four groups;
- discuss the properties of materials; and
- provide examples of applications for each material type.

Suggested Classroom Illustrations

- Differentiate and select materials based on their properties.
- Test materials for density, ductility, strength, fatigue, and electrical and thermal conductivity.
- *Read for information on material applications.
- *Choose one material and write essay on its potential use in Electrathon.
- Discuss why various products use specific materials.
- Do an internet search to identify material applications.

Suggested Unit Evaluation/Assessment

- Quizzes/Reports and Presentations – Test student's mastery of information through classroom review and discussions followed by written quizzes, reports and PowerPoint presentations.
- Hands on Projects – As an action-based course, student understanding is assessed according to resulting design activities.
- Applying Safety in the Laboratory/Safety test.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets to apply reading for information
- Worksheets and rubrics
- Internet resources

UNIT V – SYSTEMS, COMPONENTS AND PARTS

Unit Topics To Be Covered

1. Strategy for tackling a complex solution
2. Systems
3. Components
4. Parts

Unit Goal: To have students break big ideas into manageable, designable parts by identifying systems and components that need design and engineering.

Learner Outcomes

The students will:

- identify systems, subsystems, components and parts;
- be able to analyze and break a design solution into small systems and components; and
- identify the components and parts to design a system as a whole.

Suggested Classroom Illustrations

- Identify the systems of a mailbox, paper towel dispenser, or other simple product.
- Identify the systems, subsystems, components and parts to various bicycle types or an electrathon vehicle.
- Create a plan to design a simple vehicle.

Suggested Unit Evaluation/Assessment

- Quizzes/Reports and Presentations – Test student's mastery of information through classroom review and discussions followed by written quizzes, reports and PowerPoint presentations.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubric, students will use problem-solving skills to work together in small groups to complete a manufacturing task.
- Apply Safety in the Laboratory/Safety test.
- Authentic project evaluation.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets, journal
- Worksheets and rubrics
- Internet resources

UNIT VI – COMMUNICATING DESIGN IDEAS

Unit Topics To Be Covered

1. Computer use in design and engineering
2. Hardware and software
3. Creating drawings using engineering software

Unit Goal: To have students become familiar with the use and application of “Pro-Desktop” engineering software as a tool for communicating ideas and information.

Learner Outcomes

The students will:

- create and modify 3D objects according to design criteria;
- dimension objects accurately; and
- present a design idea to the class that meets a design criteria.

Suggested Classroom Illustrations

- Create a design for an electrathon freewheel sprocket adapter.
- Design a motor bracket/mount for an Etek motor.
- *Design a steering spindle bracket to accept an Avid disc brake caliper.
- Create an assembly drawing of a completed steering assembly.
- *Present design ideas to the class identifying the challenge, criteria, research conducted, safety considerations, and technical skills necessary to produce product.

Suggested Unit Evaluation/Assessment

- Quizzes – Test student’s mastery of information through classroom review and discussions followed by written quizzes.
- Test – At the end of this unit, have students complete the Chapter Review in the Student Workbook.
- Hands on Project – Using the assigned rubric, students will use problem-solving skills to work together in small groups or individually to complete a task.
- Apply Safety in the Laboratory/Safety test.
- Authentic project evaluation.

Engineering and Product Design Curriculum (Cont'd)
Unit VI (Cont'd)

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets
- Worksheets and rubrics
- Internet resources

UNIT VII – DEVELOPING COMPANY ORGANIZATION

Unit Topics To Be Covered

1. Goals and mission statements
2. Continuous process and product improvement
3. Company organization
4. Division of labor
5. Participatory management
6. Financing a manufacturing company
7. Entrepreneurship

Unit Goal: To prepare students for the creation of a mock manufacturing/entrepreneurial company.

Learner Outcomes

The students will:

- identify a company product (Electrathon vehicle, etc.);
- understand the importance of company goals and mission statements;
- organize class/team into departments;
- identify department responsibilities; and
- develop student evaluation process.

Suggested Classroom Illustrations:

- Students will create company departments – mechanical and fabrication, computer design and engineering, enterprise and promotion.
- Class discussion on the goal of their company.
- Investigate school, business and organization mission statements for the purpose of creating a mission statement for long-term project/goal.
- *Short essay – choose one company and discuss how mission statement relates to the business.
- Students define responsibility of departments.
- Discussion on creating timelines to meet established goals.

Suggested Unit Evaluation/Assessment

- Quizzes/Reports and Presentations – Test student's mastery of information through classroom review and discussions followed by written quizzes, reports and PowerPoint presentations.
- Hands on Projects – As an action-based course, student understanding is assessed according to resulting design activities.
- Applying Safety in the Laboratory/Safety test.
- Authentic project and lab evaluation.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets to apply reading for information
- Worksheets and rubrics
- Internet resources

UNIT VIII – LEARNING BY DESIGN (INDEPENDENT PROJECT)

Unit Topics To Be Covered

1. Project timelines and schedule
2. Researching available solutions to a problem
3. Creating parts and components for student directed projects
4. At this point in the course students will begin to work on a long term independent projects with the common goal of producing one classroom/company product. Each student is responsible to identify and apply individual skills to achieve the company goal. The ultimate class product can range from an enterprise endeavor, electrathon vehicle, boat, or other class venture.

Unit Goal: To provide students the opportunity to apply their design, organizational, and business skills in the manufacture of a class project.

Learner Outcomes

The students will:

- *produce written essay on research conducted identifying the design problem and current solutions available;
- determined completion date for their product/component;
- *create drawings and present/communicate to the class design solutions;
- produce a mock-up, prototype, and final product;
- assist as needed other team members; and
- assemble individual projects to produce as a team the final class product.

Suggested Classroom Illustrations

- Choose independent projects to obtain goal of the company
- Students create drawing using design software of one component
- Produce a full size mockup of one component
- *Write proposal for fabrication of component
- Justify need and timeline for completion
- *Turn in project reflection report and journal

Suggested Unit Evaluation/Assessment

- Quizzes/Reports and Presentations – Test student's mastery of information through classroom review and discussions followed by written quizzes, reports and PowerPoint presentations.
- Hands on Projects – As an action-based course, student understanding is assessed according to resulting design activities.
- Applying Safety in the Laboratory/Safety test.
- Authentic project and lab evaluation.

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets to apply reading for information
- Worksheets and rubrics
- Internet resources

UNIT IX – PRODUCT TESTING AND EVALUATION

Unit Topics To Be Covered

1. User testing strategies
2. Documenting test data
3. Getting user feedback on function, appeal, and value
4. Evaluating feedback from user testing
5. Product modifications

Unit Goal: To have students provide feedback on the appeal, function and value of product.

Learner Outcomes

The students will:

- evaluate data from testing for future design revisions;
- prioritize changes to designs; and
- organize modifications based on user feedback.

Suggested Classroom Illustrations

- Create testing procedures and techniques.
- *Create list of testing questions.
- Conduct user testing.
- Discuss how feedback from testing will be used.
- *Record testing data.
- Evaluate data and recommend modifications for design.
- Write up project report using network template.

Suggested Unit Evaluation/Assessment

- Quizzes/Reports and Presentations – Test student's mastery of information through classroom review and discussions followed by written quizzes, reports and PowerPoint presentations.
- Hands on Projects – As an action-based course, student understanding is assessed according to resulting design activities.
- Applying Safety in the Laboratory/Safety test.
- Authentic project and lab evaluation.

Engineering and Product Design Curriculum (Cont'd)
Unit IX (Cont'd)

Supplemental Activities and Resources

- Manufacturing Technology student resource books
- Lessons with PowerPoint presentation
- Handouts and study sheets to apply reading for information
- Worksheets and rubrics Internet resources

PRINT AND MEDIA RESOURCES

Reference Books:

Technology Today and Tomorrow, Sharon A. Brusic, Ed.D., James F. Fales, Ed.D., and Vincent F. Kuetemeyer, Ed.D., Glencoe-McGraw-Hill, 3008 W. Willow Knolls Drive, Peoria, IL 61614

Software:

Mastercam Version 9.1 Mill, Copyright © 2002, CNC Software, Inc., Tolland, CT

Mastercam Version 9 Router, Copyright © 2002, CNC Software, Inc., Tolland, CT

SpectraLight Mill Control Software, Intelitek , Inc., Manchester, NH

SpectraLight Router Control Software, Intelitek , Inc., Manchester, NH

SpectraLight Mill Control Software, Intelitek , Inc., Manchester, NH

Microsoft Office 2000, Microsoft Corporation, Redmond, WA, 2000

Adobe PhotoShop, Adobe Systems Incorporated, Adobe Press, San Jose, CA, 2002

West Point Bridge Designer 2003, West Point Military Academy

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, learning within a module, group discussion, individualized tutoring, peer instruction, and mentoring.

Instructional Materials:

Layout equipment, CNC Router, CNC Mill, tools, computers and software, LCD projector, Design Activity Report packet, color printers, paper, Lab equipment, machining stock and safety supplies appropriate to each unit.

WORLD OF TECHNOLOGY CURRICULUM (PILOT 2005-06)

Introduction

The World of Technology is an introductory activity-based course, which provides students with experiences in the application of technology, and an understanding of its impact on the individual and society. It focuses on the study of technology. Technical careers are explored, and students are actively involved in projects that use computers, tools, materials, problem solving skills, and the design process. Technological skills in the areas of manufacturing, construction, communication and transportation will be introduced. The World of Technology will increase awareness of opportunities in High Technology fields and help make technology *user friendly* for students.

Course Objectives

- Develop career awareness through career assessment, research, and investigation
- Involve students in the exploration of technology through hands-on activities, to uncover and develop individual talents and creative abilities
- Develop student insight into the impact of different technologies on society
- Acquire and use information to study the past, present, and future of Technology
- Provide the skills necessary to make informed career choices
- Provide a gender inclusive learning environment
- Demonstrate and integrate the practical application of basic English, Scientific, and Mathematical principles
- Explore real world problems involving the tools, materials, processes, systems, products and services of industry and technology

Instructional Methods:

Lectures, demonstrations, laboratory activities, cooperative learning, group discussion, individualized tutoring, peer instruction and mentoring

Credits: .5 Carnegie Units

Course Schedule:

Half year, 86 minute periods.

Topics Covered:

Transportation
Communications
Production Systems (Manufacturing and Construction)

Performance Standards

Educational experiences in **Grades 9-12** will assure that students:

- critically analyze a given technology against a perceived need or want;
- describe the transformation and conservation of kinetic and potential energy in mechanical, chemical and electrical systems;
- explore and describe how electricity is generated, transferred and used in modern technologies;
- use the systems model to analyze a complex technological system;
- describe the evolution of a technological system and its influence on the economy, culture, society and environment;
- identify and explore career opportunities in the areas of technology;
- investigate multiple solutions to a design problem;
- select appropriate technical processes and fabricate a prototype;
- create a product demonstrating the application of technological processes;
- use tools and procedures safely;
- forecast trends in new and emerging technologies (alternative energy sources) and their potential impacts;
- explore future labor market trends and educational needs;
- investigate space industrialization;
- investigate the universal characteristics of systems and sub-systems; and
- analyze technologies based on their positive and negative impacts.

CAPT related lessons and activities will be noted with a () throughout this curriculum*

UNIT I - TRANSPORTATION

Content Outline

- Land Transportation
- Marine Transportation
- Air Transportation
- Space Transportation
- Materials Transportation

Suggested Activities

- Develop a top ten list of why I would (or would not) want to pursue a career in transportation.
- Design and construct a vehicle that will travel on land and water, demonstrate the vehicle.
- Build a vehicle demonstrating the principles of heavier-than-air flight.
- Build a vehicle demonstrating the principles of lighter-than-air flight.
- *Identify a career goal for yourself for ten years from now and list all the things you need to do to get to that point.
- Design a vehicle and conduct vehicle impact tests, which require students to maintain the safety of an object such as a raw egg.

Competency Tests

At the completion of this unit, students will be able to:

- define transportation;
- relate individual career interests to the investigation of careers in transportation;
- explain significant developments in transportation technology;
- explain the various ways that people and goods are transported;
- list some of the most widely used applications of transportation technology; and
- list some careers associated with transportation technology.

UNIT II - COMMUNICATIONS

Content Outline

- Graphic Communication
- Electronic Communication
- Information Processing
- Computers
- CADD

Suggested Activities

- *Develop a top ten list of why I would (or would not) want to pursue a career in communications.
- Describe electronic publishing and the common uses of this technology.
- Use electronic publishing, graphic arts, and computer terms accurately.
- Select appropriate layouts and processes used with electronic publishing.
- Identify and apply the six stages through which visual design may pass.
- Apply commonly accepted design principles for text and graphics to lay out printed materials.
- Operate a scanner and a Digital Direct camera.
- Retrieve clip art.
- Operate a basic CADD system.
- Output an accurate working drawing.
- Generate a computer image of a desired object in 2D and 3D form.
- *Research five careers within the communication area.
- *Research information concerning yearly salary, high school courses needed, personal applications, and education/training needed after high school.

Competency Tests

At the completion of this unit, students will be able to:

- define graphic communication, electronic communication, information processing;
- relate individual career interests to the investigation of careers in communication;
- list some of the significant developments in communication;
- explain how people communicate electronically;
- explain how the computer is used in processing information;
- list some of the more common computer applications in information processing;
- list several other applications; and
- explain several ways that graphic communication is produced.

UNIT III - CONSTRUCTION

Content Outline

- Construction Processes
- Construction Materials
- Construction Tool and Equipment
- Business of Construction
- Designing and Engineering the Project
- Careers

Suggested Activities

- Analyze the materials a product is made of based on materials physical characteristics such as: strength, ductility, brittleness, hardness, elasticity, dimensional stability and electrical conductivity.
- *Identify a product on the market and describe its life cycle.
- Determine if a product is a durable or non-durable good.
- Visit industry where testing and evaluating is done on products.
- Interview engineers and technicians and ask them how testing is set up and how data is accessed.
- *List and describe the structural elements used in building wall systems of residential structures.
- Design and build a 1/2" scale model of a 20 foot square, studio apartment in teams of four.
- Weigh the model and calculate the efficiency rating of the structure.
- Discuss dead and live loads, and the forces exerted on the structure.
- Perform a destructive test.
- Create a floor plan using CADD for the 1/2" scale studio apartment.
- Meet the floor plan's specifications such as: full bath, kitchenette, windows and doors.
- Estimate the contractor's cost to build the studio apartment in your town.
- *Identify the related careers associated with the construction industry.
- *List skills you find enjoyable and brainstorm occupations in which those skills would be useful.
- *Identify work values and relate those values to occupations.

Competency Tests

At the completion of this unit, students will be able to:

- explain the need for construction;
- list and explain the various things people construct;
- list and explain the most frequently used construction tools, materials, and processes; and
- list some of the careers associated with construction.

UNIT IV - MANUFACTURING

Content Outline

- Manufacturing assists related to the global economy
- Manufacturing materials
- Manufacturing processes
- Measuring devices, and their uses
- Computer-Aided Manufacturing - CAM
- Robotics
- CNC
- Distribution of manufactured products
- Careers in manufacturing technology

Suggested Activities

- Make a manufacturing materials sample board.
- *Identify a product on the market and describe its life cycle.
- List countries and their manufactured products.
- Determine if a product is a durable or non-durable good.
- *Measure various metal pieces with micrometer, caliper, and other measurement tools.
- Visit industry where tooling and evaluating is done on products.
- Interview engineers and technicians and ask them how testing is set up and how data is accessed.
- Form a manufacturing company with all the different jobs and responsibilities, then develop, design, man students or people in the community.
- Identify the related careers associated with the manufacturing.
- *List skills you find enjoyable and brainstorm occupations in which those skills would be useful.
- *Identify work values and relate those values to occupations.

Competency Tests

At the completion of this unit, students will be able to:

- define manufacturing and explore other countries and their manufactured products;
- list the most frequently used manufacturing materials;
- list and explain the most frequently manufacturing processes;
- explain the design process;
- define Computer-Aided Manufacturing and explain how it differs from traditional manufacturing;
- explain how manufactured products are distributed; and
- list some of the careers associated with manufactured technology.